Diseases Of Cattle In Which Abortion Is A Common Symptom*

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WHENEVER one studies or gives thought to diseases involving reproductive organs of cattle, one invariably turns to the subject of brucellosis. This is readily understood when one considers the widespread prevalence and economic importance of the disease, as well as the fact that brucellosis occupies a significant position in so far as human health is concerned. While most of the scientific facts concerning brucellosis are well understood, there remains much to be done experimentally.

Following the discovery of the organism *Brucella abortus*, it was learned that the disease could be recognized by the employment of the complement-fixation method of diagnosis. Continued studies of serological methods of diagnosis indicated that just as reliable and possibly even more enlightening information could be gained through the utilization of the agglutination blood serum test.

The agglutination blood serum test, in which the tube method was first used but later replaced by the plate- or rapid-test method, soon came into common usage in all parts of the world. It is justifiable to say that the agglutination blood serum test method of diagnosis is as searching and revealing as is the tuberculin test. With the development of strain 19 vaccine as an immunizing agent, particularly as related to young calves, science again provided the veterinarian with an additional weapon with which the war on brucellosis could be pursued more intelligently and, therefore, more successfully.

During very recent times, popular demand for control and possible eradication of the disease has resulted in a greatly increased interest. Health departments of certain municipalities have served notice on the producers of dairy products, that, following a certain date, milk and cream products to be sold within their respective municipalities must originate from herds that are known to be free of brucellosis. Veterinarians, livestock sanitarians, and livestock owners realize that this disease occurs in all parts of the United States. They recognize that the disease may, in certain areas, be just as extensive and serious in beef as it is in dairy cattle. They further realize that it will be impossible to eradicate brucellosis in dairy cattle unless the control program includes beef cattle, especially in herds located in areas or localities where dairy cattle are maintained. The transportation of an ever-increasing number of feeder cattle from the range states to midwestern states where they are finished for beef, has developed into a major business enterprise. Many of the feed lots and fields used in the fattening of these cattle are in proximity to and not unfrequently on dairy farms. Agricultural practices of this nature will undoubtedly increase and in so doing the dissemination of disease will assume greater and greater significance.

In certain states, where dairy farming is a major industry, sanitary officials have taken steps to require that all livestock imported into their respective states be free of disease. In

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order to meet these requirements and to escape the heavy and direct financial losses caused by brucellosis, the breeders of beef cattle are manifesting a greater interest in, and determination for, a nationwide effort which will successfully control, if not eventually eradicate, brucellosis. Many sanitary officials believe that brucellosis can be controlled economically or eradicated in any herd where procedures most adaptable to a given herd are followed through under the supervision of veterinarians, provided there is full cooperation on the part of the owner. When brucellosis can be eradicated in a particular herd, it is reasonably feasible to believe that the same results can be accomplished when principles outlined for a single herd are put into effect in a county-wide or state-wide area. Three different states now are classified as being certified brucellosis-free areas. Numerous other states, in cooperation with federal forces, are actively supporting brucellosis-control programs.

Successful control measures require the identification of reactor animals. Infected or carrier animals must be restricted in their movements and finally eliminated. Failure to identify reactors and holding them in quarantine indefinitely will tend to retard various programs of control. The utilization of calf vaccination and the adoption of the milk and cream ring-test has done much to stimulate the various control programs. The ring-test, widely used in three of the midwestern states, has proved to be of considerable value in locating infected herds at low cost with comparatively little effort. This test, which is sensitive and fairly simple in application, is not intended to replace the agglutination blood serum test as a method of diagnosis. The ring test has proved to be most useful when it is systematically applied every six months in conjunction with special agglutination tests of the ring-reacting herds.

The use of strain 19 vaccine in young calves has proved to be a valuable and popular adjunct in brucellosis-control programs. Vaccination, however, must be accompanied by blood testing in order that infected animals may be located and eventually eliminated. Brucellosis can be subdued or satisfactorily controlled as has been demonstrated under farm, as well as laboratory, methods. Brucellosis can be controlled, but to do so there must be the same sort of support and cooperation with all groups of people concerned as was the case when the people decided it was time to control bovine tuberculosis in the United States.

Vibriosis and Leptospirosis

Other diseases in which the act of abortion is a characteristic manifestation include vibriosis, trichomoniasis, and leptospirosis. Vibriosis (reproductive form) and trichomoniasis, in so far as we are aware, do not possess important public health significance. The same statement may also be applied to bovine leptospirosis, except that certain types of Leptospira are pathogenic for man. While there is lack of definite evidence of *L. pomona* infection in man, it is possible that, because of its close relationship to Leptospira known to be pathogenic to man, bovine leptospirosis constitutes a potential public health menace.

Bovine leptospirosis is a comparatively new disease in the United States, or possibly it would be more accurate to say that only within very recent times has it been given much attention. Leptospirosis, involving practically all species of domestic animals, has been reported from various sections, yet little is being done from the standpoint of control.

Clinical manifestations vary in cattle — the acute form is characterized by icterus, hemoglobinuria, and emaciation; the mild form, which is no doubt the most common, exhibits rather mild and non-specific symptoms. Again, the disease will produce mastitis-like changes which may lead the clinician to believe he is dealing with one of the more common forms of mastitis. Abortions, which may occur at various stages of the gestation period, are also confusing from the standpoint of diagnosis. The above described phenomena are thought to be associated with the febrile period of the disease. The presence of Leptospira in both the milk and urine of certain infected animals indicates the seriousness of the disease from the standpoint of dissemination.

Until more adequate methods of diagnosis can be provided, control measures are of questionable value. Isolation of diseased animals, if done early, should be practiced in an attempt to prevent the dissemination of the organism. Establishment of quarantine methods and determination of the time the quarantine should be enforced, will be difficult problems for the veterinarian until adequate methods of diagnosis can be established.

Abortions and infertility in the bovine caused by *Vibrio fetus* have long been known to exist in the United States. This organism apparently affects sheep with greater frequency and severity than cattle. Recognition of vibriosis, like leptospirosis, is difficult. Diagnosis of the disease clinically presents the same difficulties as are encountered in attempts to diag-

nose brucellosis or trichomoniasis symptomatically. Vibriosis is undoubtedly on the increase in both sheep and cattle. The use of the agglutination test is far from being an accurate and reliable method of diagnosis.

Continued research dealing with different phases of infection will be required before effective and practical methods of prevention and control can be established. In our studies of brucellosis in Minnesota, we have on numerous occasions found vibriosis in both brucellosis-clean and infected herds. Possibly this has come about because of a fairly high percentage of abortions having occurred in problem herds in which we were unable to incriminate *B. abortus.* We have not at any time, however, observed herds in which we have recovered *Vibrio fetus* from aborted fetuses which have given us as much concern as brucellosis. With development of the artificial breeding programs, vibriosis has assumed greater economic importance. Artificial breeding is recommended as one of the methods of controlling this disease. On the other hand, vibriosis may be disseminated through the practice of artificial insemination. This is true also with the brucellosis and trichomoniasis, and for this reason these diseases have assumed a more important position in disease control. A veterinarian called to aid in the selection of sires to be used artificially is confronted with a real challenge. Providing health certificates for these animals is a real problem.

Trichomoniasis

The disease trichomoniasis created great interest when it was first discovered in the United States. Almost immediately following the announcement of its discovery, the presence of the disease was reported from many areas. This infection, in which the act of abortion is a prominent symptom, has, in general, been confined mainly to large purebred herds. It is difficult of diagnosis, especially in the male. The disease has received a great deal of scientific investigation, but, thus far, all efforts to effect a satisfactory method of diagnosis have failed. Ability to demonstrate the presence of the causative protozoan in the uterine and vaginal discharges of animals recently aborted, and occasionally in animals suffering with pyometra and vaginitis, is not especially difficult. The disease in the male, however, presents an entirely different situation. Here the organism may be elusive and infection may be overlooked if the animal is not carefully studied. It is a well known fact that trichomoniasis spreads mainly through the act of copulation. With this in mind, it was not long before it became a regular practice in the control of the disease to eliminate the involved sire or sires and institute the artificial insemination plan of breeding as a method of control. More recent studies have demonstrated that the disease may actually spread through artificial breeding methods. This information adds new significance to the importance of trichomoniasis. Efforts to establish an accurate and simple method of diagnosis must be renewed. In the meantime control efforts should be continued and expanded whenever possible.

Summary

Brucellosis, vibriosis, leptospirosis and trichomoniasis have at least one highly important symptom in common — the act of abortion. The presence of the causative organism in the aborted fetus is not difficult to demonstrate in brucellosis, vibriosis, or trichomoniasis. In the case of leptospirosis few, if any, investigators have found Leptospira in bovine aborted fetuses.

Science has provided the weapons essential to win the war on brucellosis. We must have the same cooperation and interest that came into existence when our country decided it was time to control bovine tuberculosis. Vibriosis is an important disease and may be on the increase. The infection, unlike brucellosis, does not present an important human health hazard. Once a valuable method of diagnosis is found, it is reasonably feasible to conclude that the disease can be controlled. Trichomoniasis has taken on renewed importance with the development of artificial insemination programs of cattle breeding. As is the case in vibriosis, the one weapon most needed from the standpoint of control is a satisfactory method of diagnosis. Trichomoniasis must be recognized economically as a highly important disease. It is, however, not to be compared to brucellosis from the standpoint of importance. Leptospirosis in cattle has much in common with brucellosis, trichomoniasis, and vibriosis, yet it differs considerably in that it does, in certain forms, present a marked febrile stage, and death of affected animals is not uncommon. That leptospirosis constitutes a human health problem is a strong possibility. However, until we have established an accurate and simple method of diagnosis and until we know the ways in which the disease may spread from animal to animal and from farm to farm, development of control methods will be slow.

Manifestations Of Bovine Leptospiroses*

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THE association of leptospirae with disease in cattle was first reported by Michin and Azinov[1] from the North Caucasus in Russia in 1935. Other investigators have subsequently reported studies of naturally occurring and experimentally induced bovine leptospirosis in south Russia,[2] Australia,[3] Palestine,[4] and Japan[5].

Bovine leptospirosis in the United States was first reported by Jungherr[6] from Connecticut in 1944. This was followed by the reports of Marsh[7] from Montana in 1945, Mathews[8] from Texas in 1946, and Sutherland and Morrill[9] from Illinois in 1948. In these outbreaks, leptospirae were demonstrated on histopathological examination of tissues from affected animals. In addition, Mathews and Sutherland and Morrill recovered leptospirae by guinea pig inoculation. Unfortunately, these organisms were not established *in vitro*, and the identity of the strains involved could not be determined.

In 1946, Baker and Little[10] reported isolation of an agent from cows suffering from a febrile disease characterized by production of bloody and thickened milk. Their continued study of the agent[11] reported in 1948, demonstrated it to be a Leptospira. The disease seen in naturally occurring cases was reproduced in experimentally infected cows. The organism was likewise shown to be pathogenic for calves and laboratory animals. Since this time, other workers have recovered leptospirae from outbreaks of disease in dairy and beef cattle in Pennsylvania,[12] New York,[13] West Virginia,[14] Georgia,[15] California,[16] and Virginia[17].

In addition, serological evidence of bovine leptospirosis has been found in Delaware, Maryland, Florida, Kentucky, Alabama, Louisiana, Ohio, Indiana, Illinois, Iowa, Kansas, Nebraska, Wisconsin, Colorado, Montana, and South Dakota. It appears only reasonable to assume the presence of leptospirosis in cattle throughout the United States.

Leptospiral strains isolated in New Jersey by Baker and Little were identified in our laboratory as *L. pomona*,[18] as were all other North American bovine isolates thus far submitted for classification and identification studies. This organism has been shown to be associated with equine recurrent iridocyclitis (periodic opthalmia)[19] and to infect swine[20] in the United States. Infection in man with *L. pomona* in the United States has been reported by Beeson[21] and by Schaeffer[22].

Although only one leptospiral species had thus far been isolated from cases of bovine leptospirosis in the United States, probability of infections in cattle with other strains could not be discounted. Serological evidence[23] has been obtained of a second, antigenically distinct Leptospira infecting cattle in the southern United States. It seems appropriate, therefore, to consider manifestations of bovine leptospirosis in general, and not to limit consideration to *L. pomona* infections alone.

Symptomatology in Individual Animals

Naturally acquired bovine leptospirosis may be manifested as acute febrile disease terminating in death within a few days, or, with all intermediate degrees of severity and duration it may be observed as an inapparent infection detectable only by laboratory studies. In this respect, bovine leptospirosis is essentially comparable to the disease in man, where factors of age, individual resistance, and the nature of the infecting strain combine to present an extremely wide variety of clinical manifestations.

For convenience in discussion, bovine leptospirosis may be divided into the syndromata of leptospiral hemoglobinuria, leptospiral mastitis, and leptospiral abortion. Any or all of these may be exhibited in a single herd or individual animal.

Leptospiral hemoglobinuria was the first of the bovine leptospiroses recognized. This syndrome has been described in animals of all ages and in both dairy and beef cattle. In general, the disease has occurred most often in calves and young animals, with attendant morbidity of 60% and mortality of almost

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100%. Characteristically, the disease is sudden in onset, and associated with fever ranging from 104 F. to 107 F., lasting from one to five days. Anorexia and depression are observed during the febrile period. Anemia and icterus are apparent early in disease and may continue for several weeks. Appearance of hemoglobinuria may be as early as the initial febrile period and may persist for hours or days. The urine ranges from light pink in mild, transitory cases, to deep reddish black in severely affected animals. Diarrhea is associated with the early febrile stage and is often followed by constipation. In fatal cases, death may occur as early as the second day. In the opinion of Reinhard, death in bovine hemoglobinuria may be attributable to massive destruction of erythrocytes by invading Leptospira, with resultant fatal anoxemia. In nonfatal cases, illness may extend over a period of several weeks and incomplete recovery frequently has been observed; such animals may continue as stunted, unthrifty, and non-profitable individuals. Recurrence of the disease in animals which have recovered from natural infection has not been reported. Inferentially, one may assume immunity to the infecting strain to persist for the lifetime of the animal. Experimental evidence, however, indicates no appreciable cross immunity between different leptospiral strains.

Leptospiral mastitis, characterized by production of bloody and thickened milk, was first described by Jungherr and was the outstanding clinical feature of the outbreak studied by Baker and Little. Since then, this has become an increasingly recognized manifestation of the disease. In the experience of Baker and Little, udders were soft and flaccid, a finding they considered virtually pathognomonic. Other investigators, however, have reported hard, swollen udders. Probably the most reasonable explanation for this seeming discrepancy may be that Baker and Little were describing leptospiral mastitis uncomplicated by concurrent bacterial mastitis, while the other reports dealt with mixed bacterial and leptospiral invasion of the udder. All reports describe sudden, dramatic, virtually complete curtailment of milk production in lactating animals. The secretion which can be obtained is thickened, yellowish, blood tinged, and may contain recognizable blood clots. The animal usually recovers quickly, but lactation is only very slowly resumed and seldom attains the level produced prior to the attack.

Abortion as a manifestation of acute bovine leptospirosis is being increasingly recognized. Recent outbreaks in Brucella- and Vibrio-free herds which we have investigated were characterized primarily by abortion relatively late in pregnancy. Except for abortion itself, or dropping of non-viable calves, dams exhibited little or no evidence of disease. We have encountered transitory moderate hemoglobinuria and a few instances of retained placental membranes. Sippel describes an edematous navel and umbilical cord as characteristic of the fetuses aborted. Unfortunately, in most investigations, range and pasture abortions resulted in most fetuses being markedly decomposed before they were submitted for examination and no characteristic features could be observed.

Herd Outbreaks

Published reports of outbreaks of bovine leptospirosis in herds of cattle indicate extreme variation in both morbidity and mortality rates. In general, young animals, calves, and feeder stock are most frequently concerned in explosive outbreaks of leptospiral hemoglobinuria. In such outbreaks studied in the United States, serologic investigations have shown virtually the entire group of survivors to be infected, while losses have ranged from 10 to 50% of the original group.

On the other hand, herds of mature cattle involved in leptospiral abortion storms have most frequently shown abortion rates in the general order of 5 to 10%, despite serologic evidence of infection approaching 100%. It appears most probable that lower morbidity in herds of mature animals is a reflection of two major factors: First, the prevalence of leptospirosis is such that many animals must have experienced inapparent infections with resultant immunity to subsequent infection; and second, studies in laboratory animals lead to the inference that mature animals, even with no prior experience with the infections, are refractory to exposure which result in severe and often fatal disease in the young.

The Role of the Organism

Leptospirae have been demonstrated to be infective for cattle when injected parenterally or when placed upon the nasal and ocular mucosa. Efforts to reproduce disease by feeding infected material have been unsuccessful. Having gained entrance to the body, the leptospirae rapidly multiply and a generalized leptospiremia is developed. This is associated with the febrile period of disease. The incubation period has been experimentally determined to vary from one to 11 days in susceptible calves.

The duration of leptospiremia varies from one day to a week, after which time organisms disappear from the blood and are found only in localized nesting sites. Leptospiral invasion of the udder in lactating animals is associated with the period of leptospiremia, and during this period secretions of the udder are heavily contaminated.

From the standpoint of spread of infection, the most significant phase of the organism's invasion of the host, is its nesting in tubules of the kidney. Here, leptospirae may persist and multiply for many months. Such renal carriers shed the organisms in their urine and thus provide for recontamination of premises and spread of infection. Animals which recover from clinically apparent disease and those experiencing only inapparent infection are equally prone to manifest the renal carrier phase.

Clinical Diagnosis

It is apparent from the wide variety and severity of bovine leptospirosis, that these infections may simulate many other diseases of cattle. Leptospiral hemoglobinuria must be differentiated from clostridial "red-water," bracken fern poisoning, and anaplasmosis. Abortion storms pose the problems of excluding brucellosis, vibriosis, and trichomoniasis. Mastitis may be complicated by the simultaneous presence of more common bacterial invaders of the udder. In essence, it appears that the veterinary practitioner must in most cases rely upon laboratory confirmation of his diagnosis and that, from his standpoint, yet another group of possible etiologic agents must be considered. The index of suspicion of leptospirosis will be materially raised, when such factors as known freedom from brucellosis, or age below known susceptibility to anaplasmosis are considered. New introductions into a herd, or new exposure to other potential carriers, such as swine and horses, may be of additional significance.

Laboratory Diagnosis

Definitive diagnosis can be afforded only through isolation and subsequent identification of infecting leptospiral strains. This can be accomplished by blood culture of febrile animals or by recovery of organisms from body fluids through the medium of laboratory animals. In most instances, leptospiral culture media, laboratory animals, and suitable specimens will not be available. In these situations, laboratory confirmation can be made by serologic examinations. Either of two technics may be employed, complement-fixation or agglutination. In both, laboratory diagnosis is based upon demonstrating a rise in antibody level in serial serums drawn from the affected animal. Antibodies, both complement-fixing and agglutinating, usually first appear at the time of abatement of fever and reach their maximum levels in the second to fourth week of disease. In order to demonstrate this diagnostic rise in titer, it is necessary to obtain a serum specimen early or during the febrile period, followed by a second specimen obtained ten to 14 days later. Single serum specimens showing high agglutination titers are indices of experience with leptospirosis, but unfortunately because of long persistence of these antibodies, do not permit close estimation as to the time infection was experienced. Complement-fixing antibodies, however, in most cases do not persist long after convalescence, and here single positive tests may in general be taken to indicate relatively recent infection.

Control and Prophylaxis

Up to the present, no therapeutic or prophylactic agents have yet been shown to be efficacious in bovine leptospirosis. Research investigators are endeavoring to develop satisfactory vaccines for bovine use. To be of value, such vaccines must not only prevent clinically apparent infection, but also the formation of renal carriers as a result of inapparent infection. Further, it is evident that at least two immunogenically distinct leptospirae may infect cattle in the United States, and therefore, polyvalent vaccines protecting against all strains found in cattle in this country are required.

Control measures which appear feasible at the present time are limited to serological examination of newly acquired animals before introduction into herds, segregation of swine and horses from cattle, and subdivision of large herds in endemic areas in an effort to limit spread of such infections as may occur.

Summary and Conclusions

Bovine leptospiroses in the United States are widely prevalent, newly recognized infections. They are probably of long standing in this country, and their true etiology is only currently being demonstrated. The manifestations of these diseases vary in extremes of severity from acute, fulminating fatal hemoglobinuria to inapparent infections. Abnormal milk production and abortions are recognized symptoms. No proved effective therapeutic or

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Anthrax Immunization Of Cattle In Kern County, California

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THERE appears to be considerable difference of opinion as to effective methods for preventive immunization of cattle against anthrax in those areas in the United States where this disease occurs annually. There also seems to be considerable difference in severity or even probability of exposure of animals pastured on some known anthrax-contaminated land as compared to other areas. It is, therefore, conceivable that a higher degree of immunity may be needed to protect cattle in one area than would be necessary in an area where the level of exposure might be less severe. In any case, a variety of products are available for immunization against this disease and all of them seem to enjoy a measure of popularity. It is apparent, however, that products which might be deemed effective in some anthrax areas do not produce an immunity of sufficient degree or duration to withstand the exposure cattle might receive on more dangerous pasture; at least, one would be inclined to reach such a conclusion in view of apparent failure of bacterin and some of the weaker spore vaccines to provide ample protection in some notorious anthrax areas. In any case, reliance has been placed on stronger spore vaccines in our area.

Two important considerations in selection of anthrax vaccine are:

1. *Safety*. Any vaccine used in prevention of anthrax must be capable of inducing a high degree of protection without danger of producing disease in the vaccinated animal.

2. *Immunizing Ability*. The most potent live spore vaccine that can be used safely must be used to accomplish strong immunizing stimulus for production of immunity that will withstand the virulent exposure expected.

Perhaps less important considerations in selection of an anthrax vaccine, but very important to us, all other factors being equal, are such things as dosage which can be conveniently measured, and the route of administration which can permit rapid handling of range animals. Spore vaccines administered intradermally are reported to produce very satisfactory immunity. However, dosage is small and the intradermal route of administration, which is important for safe and effective use of that vaccine, is not as conveniently applied under range conditions as the subcutaneous route with administration of 2 cc. of vaccine.

The problem of anthrax control is handled satisfactorily on the extensive ranch of the Kern County Land Company in California by annual vaccination.

Prevention of anthrax in our large animal practice in Kern County is a most important consideration. Anthrax has been a serious cause of losses in both pastured cattle and sheep for many years. Fortunately, my predecessors in this practice, Doctors Edwards and Edgar, had effectively controlled this disease through use of improved anthrax vaccines and, therefore, passed on much valuable experience in the use of effective methods of prevention. My experience, therefore, has been concentrated in the use of immunizing methods for prevention and control which they had found most effective in widespread use in this large anthrax area.

Kern County is a semi-arid region at the extreme southern end of the San Joaquin valley of California. The average yearly rainfall is seven inches, most of which falls between October and April. Cattle, therefore, may have green grazing in native hill pastures from early winter until early summer, but normally native pastures are dry and may be

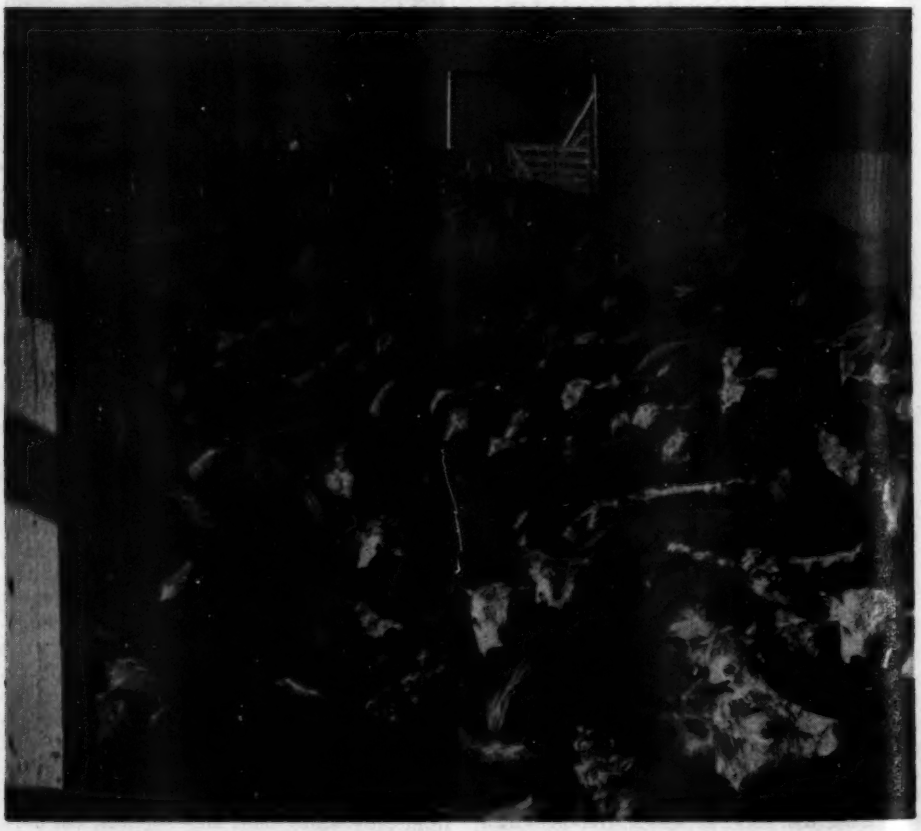
grazed short in early June. The rest of the year irrigated pastures or high mountain meadow pastures are depended upon. Some low native pastures, though dry, are saved for fall and winter feed before the new grass comes on, and on these dry pastures the cattle have to glean filaree and foxtail close to or on the surface of the ground.

Past history has shown that all, or essentially all, of native low pastures and some of the mountain meadow pastures have been thoroughly seeded with anthrax. Probably all of the irrigated lands are potentially dangerous for cattle susceptible to anthrax. These lands are all seeded with spores from the carcasses of animals dead of the disease during the many years when it was not, and could not be, adequately prevented or controlled.

Since our native pastures may be grazed close in June, the dangers of anthrax soil-intake in grazing animals increases and these same pastures, if saved for fall pasture, are hazardous until the green grass comes on. Consequently, immunity must be established in the spring before cattle are subjected to dangers of close grazing and potentially heavy exposure.

The Kern County Land Company, which grazes large numbers of cattle on wild and cultivated pastures, affords an opportunity to examine practical anthrax control methods under large scale operations and to observe results obtained. During each year, there are received by this company cattle which originate from subsidiary ranches in Oregon, Arizona, and New Mexico, as well as cattle purchased throughout the western states. These shipments include weaners, yearlings, two-year-olds, cull cows, and bulls. The majority of these animals are from anthrax-free areas and should, therefore, be susceptible.

Each spring all of the cattle to be grazed on



Cattle are crowded into holding corral in the early morning, preparatory for vaccination.

Kern County ranches during summer months are vaccinated for anthrax by subcutaneous injection with anthrax spore vaccine no. 4 (aluminum hydroxide adsorbed)*. This product has been in use for immunization against anthrax on this ranch since 1937. Approximately 60% of the cattle vaccinated each year are new additions to the ranch and have had no previous experience with anthrax either by contact with infection through grazing, or by vaccination. The other 40% of the animals vaccinated each year are carry-overs from the preceding year and were vaccinated a year earlier. This is pointed out to establish the safety of the vaccine since 60% of the animals that receive the anthrax spore vaccine no. 4 each year have had no immunity to the disease. The other 40% might have some holdover immunity from a previous vaccination or possible exposure to the disease while vaccinal immunity is in force.

We vaccinate early in the morning and as many as 2,000 animals per day may be handled. Equipment is highly efficient so that 500 or more an hour can be handled easily. In my experience the past few years, approximately 20,000 cattle per year have been vaccinated. No cases of anthrax have resulted from vaccination with aluminum hydroxide adsorbed no. 4 spore even though approximately 60% of the animals vaccinated were animals which had no previous experience with anthrax.

By this method of annual preventive vaccination, anthrax has been effectively controlled in this large ranching operation. However, we have found that if cattle are to be held on certain of our pastures longer than six months after vaccination it is well to revaccinate them. In 1948, three bulls died in the late fall in one of these heavily contaminated pastures. These animals had been vaccinated the previous early spring. Revaccination of the other animals in the pasture by subcutaneous injection of a 2 cc. dose of anthrax spore vaccine no. 4 (special) administered simultaneously with 50 cc. of anthrax antiserum stopped loss immediately.

In 1949, anthrax was diagnosed in a group of heifers. This was the first loss of animals on this particular field in 25 years. This loss occurred in the fall of the year and we are not sure whether these animals had been vaccinated the previous spring or whether they were animals purchased and placed on these pastures in the fall of the year. The records are not clear on this point. In any case, simultaneous administration of anthrax spore vaccine no. 4 and 50 cc. of antiserum promptly stopped losses. Three animals sick at the time the healthy animals were vaccinated responded to treatment with penicillin and anthrax antiserum. Any animals vaccinated in the spring which are to be held beyond six months on the ranch on known contaminated pastures are now revaccinated within six months of original vaccination.

It is hoped that this experience with anthrax spore vaccine no. 4 (aluminum hydroxide adsorbed) will be of interest to other veterinarians having similar problems of prevention in areas where anthrax is known.

*Charbonol, produced by Cutter Laboratories, Berkeley, Cal.

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Progress of Atrophic Rhinitis Studies

There is much to be desired in the nature of evidence before trichomonads can be incriminated as the etiological agent of atrophic rhinitis. Other workers have implicated viruses or other organisms.

The disease begins insidiously and gains virulence in the second and third year. Mortality may be as high as 30% prior to weaning, with another 30% dying subsequently. Other animals may show a delay in reaching market weight, or no changes at all.

Some practitioners have found apical lung consolidation a typical autopsy finding, in addition to the rhinitic findings. Pneumonia may entirely account for the stunting.

Diagnostic measures also suffer from insufficiency. Rhinoscopic examination of infected swine has proven only 55% effective in some competent hands.

Some prevalent field treatments of the condition, whether empirical or not, but believed to be effective by some, are: (1) Erysipelas serum and culture given soon after birth; many herds have shown response to this treatment, making normal gains, but turbinate atrophy is unaltered. (2) Two or three streptomycin injections in the first few days of life; growth may be normal, but turbinate alteration is unaffected. (3) Antibiotic feeds; these seem to bring the swine through the infection, but turbinate alteration remains prevalent.—*H. E. Goldstein, Columbus, Ohio.*

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Federal quarantines have been imposed on a county in Illinois and three in Ohio because of the disease of sheep known as scrapie. The quarantines prohibit interstate movement of sheep from infected areas.

Antimicrobial Nitrofurans In Mastitis And Dermatomycoses*

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THE first public disclosure of the antimicrobial action of 5-nitro-substituted furans was made in 1944 by Dodd and Stillman of Eaton Laboratories[1].

Examination of the antibacterial action of several nitrofurans indicated that in high concentration, they were slowly bactericidal (bacteria killing) while the lower concentrations were bacteriostatic (bacterial growth inhibiting). The effectiveness of the nitrofurans in inhibiting the growth of bacteria extends to both Gram-positive and Gram-negative organisms. It was found that furacin® has a wide antibacterial spectrum. Bacteria develop only a very limited amount of resistance to the action of this antibacterial agent. It retains effectiveness in the presence of milk, pus, blood, and serum. Like the antibiotics, furacin acts by disrupting the enzymatic metabolism of the bacterial cell. It has low tissue toxicity and it does not interfere with phagocytosis or healing.

In present day veterinary medicine, furacin is used widely for prevention or treatment of surface bacterial infections as in wounds, burns, pyodermas, ulcers, skin grafts, osteomyelitis, rhinitis, sinusitis, conjunctivitis, otitis, metritis, cervicitis, and vaginitis. It is administered *per os* in porcine enteritis and avian coccidiosis.

Veterinary Use of Furacin

Soon after the introduction of furacin to physicians, some veterinarians became aware of its value for topical therapy in various animal conditions. In April 1946, Dr. Maynard H. Mires of New York, first used furacin solution (the human preparation) for the treatment of bovine mastitis. This product in some instances was irritating to mammary tissue. After laboratory and clinical study of the human product, the factor causing irritation to the udder was found to be the wetting agent which is used for its penetrating effect in wound therapy. The product was then compounded, omitting the wetting agent; this was tested by Doctor Mires[2,3] and found to be efficacious for the treatment of bovine mastitis. The product was named furacin solution veterinary. It is a 0.2% aqueous solution which is permanently stable and is composed of the following:

Furacin	0.2%
Carbowax 1500	65.0%
Water q.s.	100.0%

Since the early study by Mires, other investigations in the same field have been conducted by Carpenter[4] at Rochester, and Kakavas[5] *et al.* in Delaware.

During 1951 and 1952, I had the opportunity in one particular experiment to treat approximately 200 lactating quarters affected with chronic mastitis. These quarters produced abnormal milk and revealed varying degrees of induration with fibrosis. Milk production was reduced and fat content lowered. In most cases these were individual treatments because mastitis was not a herd problem. With the hope of having the medicament well dispersed throughout the gland, a machine known as a carbatom was employed. A report on some studies with this technic was made by Doctor Walker[6] of the University of Pennsylvania Bolton farms.

After testing various agents, it was decided to use furacin solution veterinary—because of (1) its physical properties, especially its viscosity; and (2) its lack of irritation.

To the furacin solution was added penicillin, streptomycin, or terramycin. After a number of trials, the optimum carbon dioxide pressure for intramammary medication was found to be 40 lb.

The results of this particular method of therapy for chronic mastitis which employed the administration under CO_2 pressure were such that all cases of chronic mastitis not under herd survey were treated in this manner. Some quarters that were sampled for laboratory culture prior to therapy did not show sterile milk in samples collected at a later date

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following treatment, but the milk secretion became normal and the process of induration within the gland was arrested. Many of the cows thus treated that would have otherwise been culled were saved for milk production. Results of mastitis therapy by this technic can best be explained by the physical demonstration of its action. The liquid under pressure is ejected through the cannula in a fine mist. After treating a quarter by this method, crepitation can be elicited over most of the gland surface, indicating widespread dispersion of the drug within the quarter.

Following veterinary acceptance of furacin solution veterinary as a therapeutic agent in bovine mastitis and the results of Mires[7] and Kakavas[8] who demonstrated the potential effect between furacin and penicillin against mastitis organisms, Eaton Laboratories compounded these agents in a vehicle to form a product named furacin-penicillin gel®, a brand of procaine penicillin G and nitrofurazone in oil. This material is a concentrated suspension of microcrystals in a vegetable oil base and consists of the following:

Furacin	20 mg.
Procaine penicillin G	13,333 units
Peanut oil with 3% aluminum monostearate q.s.	1.0 cc.

In this material, penicillin is stable for a period of at least three years. The furacin content in the gel is ten times greater than in the solution since each cc. of the latter contains 2 mg. of furacin whereas each cc. of the gel contains 20 mg.

Several studies have been conducted with this material to evaluate its effectiveness against bovine mastitis. A paper listing results of preliminary studies and presented for publication by Roberts, Kakavas and Biddle[6] showed this combination to be effective against the common mastitis organisms and to be non-irritating to mammary tissue. To determine irritation, three factors were considered: (1) effect on leukocyte count, (2) effect on character of milk, and (3) mammary tissue reaction. Extensive study showed the gel to be non-irritating by absence of a significant increase in leukocyte count, no abnormal change in gross appearance of the milk, and lack of glandular swelling following intramammary administration.

Further experiments over the past ten months have demonstrated the product to be effective against mastitis due to pathogenic staphylococci (*Micrococcus pyogenes* var. *aureus*). From four studies made on herds where there were outbreaks of mastitis, 86% of the quarters infected with staphylococci became negative following therapy. In order to evaluate this combination properly, no changes in management of milking procedures were advocated which could influence the results. In one particular test covering a six month period, 32 cows having a total of 60 infected quarters were treated. Each infected quarter was treated with 7.5 cc. furacin-penicillin gel at 24-hour intervals for a total of three injections. Approximately two weeks following therapy, milk samples were collected and cultured in a control laboratory. Sampling of this herd continued at monthly intervals. The experiment may be summarized as follows:

Organism	No. Infected Quarters	No. Quarters Recovered After 2 Treatment Series	% Recovery
Micrococcus pyogenes var. *aureus*	32	29	91
S. agalactiae	24	21	88
Other streptococci	1	1	100
Pseudomonas aeruginosa	3	2	66

In summary, the treatment of bovine mastitis today poses specific problems that were less important a short time ago. We must realize that many of the cases we are called upon to treat are ones that the dairyman has failed to cure. The mastitis that requires veterinary assistance is less and less frequently due to *Streptococcus agalactiae*; therefore, emphasis must be placed on other mastitis organisms. The pathogenic staphylococci and coliform bacteria are becoming common factors in this disease. These are serious infective agents and require effective medication. Early therapy of sub-clinical mastitis gives best results.

Veterinary Use of Furaspor

The second part of this paper considers another nitrofuran and its antimicrobial effects on dermatomycoses. This therapeutic agent is furaspor®[1], brand of 5-nitro-2-furfuryl methyl ether. It is one of the few compounds of the nitrofuran series that is liquid.

Laboratory studies were conducted with furaspor to determine its effect on fungi and bacteria. The results proved that this agent was highly fungicidal as well as bactericidal *in vitro*. During this experiment, it was found

®[1]Eaton Laboratories, Inc., Norwich, N. Y.

that the vehicle employed had a decided effect upon its fungicidal properties. Following comparative tests, it was determined that an emulsion base vehicle gave furaspor the greatest fungicidal activity. This is the present vehicle used. It has the following formula:

Furaspor	0.4%
Hyamine 10X	0.5%
Benzyl benzoate	15.0%
Tween 20	60.0%
Water q.s.	100.0%

The hyamine 10X is a quaternary ammonium compound that is an antiseptic and a deodorant. The usual amount of benzyl benzoate in mange preparations is from 25 to 35%. From tests with benzyl benzoate in furaspor liquid veterinary, it was found that acaricidal activity was obtained with only 15% benzyl benzoate. Because of the presence of this particular ingredient, the drug is not recommended for feline medication. *In vivo* toxicity studies were conducted on cats. All cats subjected to daily external applications on unbroken skin of 4 cc./kg. became ill during the 35-day test period. Cats treated in the same manner with an equal amount of furaspor liquid veterinary containing no benzyl benzoate, remained healthy throughout the entire experiment. Practitioners must be aware of the toxicity of benzyl benzoate for cats even in minute quantities.

Similar studies were conducted on dogs with no signs of toxicity.

Over a period of 18 months, several investigations were conducted to determine efficacy of furaspor against fungal infections in various animal species. At the same time mange was also studied.

In the routine examination of animals, fungal infections can often be diagnosed by rubbing the hand lightly over the involved area against the direction of hair growth. If short, stiff bristly hairs can be detected differing in character from other hairs on the unaffected body regions, many cases will be positive for fungal disease. These stiff hairs are due to the breaking off of infected hairs which leave stubs. To confirm diagnosis, a Wood's lamp can be employed. In most cases the fungi will not fluoresce; it is then necessary to make a microscopic examination and, in some cases, laboratory culture. Some skin scrapings[9] in areas of fungal infections do not fluoresce and are negative to microscopic and cultural examinations. Infected hairs, when examined in these areas, reveal fungi. Some investigators claim that the only infallible clue is an infected hair stub. Sabouraud's medium is usually the one of choice for laboratory culture.

In treating dogs with fungal infections, a definite procedure should be followed in order to attain good results. If necessary to bathe an infected animal, a good washing agent is composed of the following:

Saponated cresol solution (Lysol)	10%
Liquid soap	90%

This is spread over the area, thoroughly moistening all the hair, left in place for 15 minutes and then washed off. Monash[10], in experiments where he tested the fungicidal action of various substances, revealed a number of misconceptions. Some of the substances found to lack fungicidal action on hairs infected with *Microsporum audouini* are as follows: 50%, 70%, or 95% ethyl alcohol, 70% or 99% isopropyl alcohol, sodium thiosulfate 10% in water, carbon tetrachloride and tincture of green soap N.F. Saponated cresol solution 10% was fungicidal. From the results obtained with the soap, it is apparent that ordinary shampooing, far from preventing the spreading of infected hairs, actually serves mechanically to spread the infection because of its lack of any fungicidal action.

In the therapy of these conditions, potassium permanganate compresses[11] can be applied to the lesions. These should be hot compresses, following which furaspor liquid veterinary is applied. The method of application outlined by Pipkin[12] is followed—remove loose hairs when possible, use soft tooth brush and brush in medicament, stroke in direction of hair growth. Applications can be made daily for three or four days, then applied semiweekly as necessary. Early improvement is noted and normal hair growth often begins within two weeks. In some advanced cases, a saturated solution of potassium iodide, five drops three times daily given internally, will stimulate local allergic response[10].

The results to date indicate the drug to be very effective against the small isolated lesions of fungal infections on dogs. These lesions are areas irregular in outline, denuded of hair, and often without gross skin change but may be somewhat smooth in appearance.

Ringworm

Classical ringworm in domestic species responds to therapy in most all cases. A few animals with ringworm have not responded with the usual course of treatment. As with man, a number of fungi cause similar lesions.

Although ringworm is the name given to a clinical entity, it may be caused by one or more fungi and, therefore, involve an organism resistant to usual medication. Gordon[14], in a treatise on veterinary mycology, stated that it is almost a dictum among medical mycologists that there is no mycosis without definite demonstration of the causative organism. Part of the reason for this is that a given set of symptoms may be caused by any number of specific fungal organisms or by a nonfungal agent, whereas a single fungal species might produce diseases of widely varying characteristics. Correct identification of the fungus involved will enable the practitioner to refer to related previous cases, as well as to make a logical approach to treatment. Therefore, a specific diagnosis is usually a necessity.

Otitis

Microsporum ear infections of dogs respond to therapy with furaspor liquid veterinary. This is a common condition affecting many breeds but is more prevalent in dogs with long ears that have heavy hair growth. Affected animals were treated using the method previously outlined. In two cases, there was smarting following treatment as evidenced by head shaking; after the second application, this was no longer noticed. Semiweekly treatments were continued for four to six weeks in order to assure complete recovery. Several of these dogs had long standing infections and had received other treatments for as long as two years without results; after treatment as outlined above, cures were obtained in these obstinate cases.

Another condition responding to this particular drug is parasitic otitis. A number of dogs with resistant ear infections from which the Otodectes mange mite was isolated, responded to a course of daily treatments and completely recovered.

Intertrigo in Cattle

A much discussed disease in cattle, intertrigo, is controlled by furaspor with resultant healing. Intertrigo is an eczematous condition of the ventral surface of the udder, occurring on the mid-line. The condition is described in medical literature as occurring under the breasts of women. The etiological agent is considered to be a fungus. With this factor in view, a number of affected cattle was treated with an alcoholic solution of furaspor. Since the condition is obstinate to most treatment, results were readily determined. Treatment of affected cows to date has been successful. The method is as follows:

1. Cleanse area following milking, removing all debris.
2. Apply furaspor by means of a dauber to cover the lesion completely.
3. Repeat following each milking and continue as necessary.

The usual duration of therapy is about ten days. Long standing cases may require additional applications.

Of interest is the factor of contagion. Dr. Everett Denlinger,[15] of Pennsylvania, noted three cows with intertrigo on one farm this summer. The first animal had been affected for three months. The farmer had treated this cow unsuccessfully with a number of drugs. A liquid preparation containing gentian violet confined the lesion, but did not cure it. After medication with furaspor for two weeks, the lesion disappeared. About 12 days later, the farmer called for veterinary assistance—another cow had intertrigo. She had been placed in the same stall during milking hours where the former affected animal was kept and treated for three months. Treatment for one week resulted in recovery. A short time later the farmer again called, and another cow was found to have the same condition. She too had been placed in the same stall where the first two animals were kept. A course of therapy for seven days resulted in complete recovery.

In addition, demodectic and sarcoptic mange in dogs, sarcoptic and chorioptic mange in horses, and sarcoptic mange in cattle have been successfully treated with furaspor liquid veterinary. The drug is best applied by a short, stiff-bristled brush which facilitates intimate contact of active ingredients at the site of infection. Cattle may be sprayed to expedite therapy. The eyes should first be properly protected with some ophthalmic ointment to prevent any possible irritation.

Summary

In summary, an attempt has been made to outline the present status of work on the nitrofurans based on both published and unpublished studies. The development of the potentialities of the nitrofurans as therapeutic agents requires additional investigative study with chemical, biological, and clinical surveys. From such investigations veterinarians will gain new tools to combat disease.

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(Continued on page 230)

Cesarean Section In The Cow*

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CESAREAN section in the cow is nothing new, and nearly every veterinarian has the knowledge and training necessary to perform the operation. Elimination of unnecessary frills will encourage performance. Although the hospital is the preferable place for this type of work, it can be done on the farm. While it is not necessary to have elaborate facilities, the importance of cleanliness and aseptic technic should not be minimized. The success or failure of these efforts will reflect the amount of care taken in performance of routine duties. One's ingenuity will be challenged innumerable times, and ability to cope with these will be reflected in the results.

A most important objective is to encourage the older men especially to do this operation. Error is often made in attempting to effect delivery by different methods. The practitioner should not be influenced by other contentions as much as by knowledge of the necessity and advantage of the operation.

Indications

The indications for cesarean section are: (1) oversized fetuses, (2) malpresentations, (3) malformed fetuses, (4) torsion of the uterus, (5) emphysema, (6) traumatic gastritis, and (7) pelvic injuries.

Oversized fetuses are the most important and frequent. Any veterinarian who has worked in a cattle country for any length of time will have had to deal with oversized fetuses, or large fetuses in young heifers that have not matured sufficiently to be able to deliver a calf normally. In these cases, cesarean section can accomplish desired results with much greater ease than performance of an embryotomy, and if one is not too late, the calf can also be saved. If proper care is given, losses should be almost *nil;* and as time goes on improvements in all phases of medicine and surgery should bring results up to a parallel with those in man.

Malpresentations are second in importance. In certain of these, in which correction is extremely difficult or impossible due to the length of time that the animal has been in labor, or to rapid contraction of the uterine wall, cesarean section can be employed to great advantage. In some of these, embryotomy is tedious and may be more time-consuming than section, and more exhausting. In some cases in which the uterus contracts rapidly, the wall may rupture and laparotomy may be necessary for repair. This can be difficult and may endanger the life of the animal to a greater degree than cesarean section. In a large number of these malpresentations, labor has progressed for hours or perhaps days, in which case presentation is dry. Rough manipulation invariably ends in traumatic injury.

Malformed fetuses are third in importance. Practically the same can be said for these as for oversized fetuses. There are, of course, those cases in which one or two divisions with a fetotome will permit delivery, but there are others when a half day could be spent at hard labor, only to find that the head is too large to pass through the pelvic canal. Some examples of this class are two-headed calves, Siamese twins, etc. These are rather rare, but cesarean section turns this type of case into one of simple course.

Torsion of the uterus is another indication. Torsion, so complete that entrance into the uterus in the usual manner is impossible, can be handled best by section. There may be cases in which, while one is able to effect correction, the cervix is not dilated and may not dilate owing to the disturbing influence torsion has on the endocrine system. Cesarean section will relieve the situation easily.

In some cases of emphysematous fetuses, section is the only possible solution. In these, a guarded prognosis should be given; however, one should not despair as the organisms causing the emphysema may be saprophytes. It is especially necessary to guard against trauma of healthy tissues. Operation can be performed successfully when it is physically impossible to pass the hand between the fetus and the vaginal wall.

Traumatic gastritis (foreign body penetration) in advanced pregnancy may be indication for cesarean section. Some of these patients become critical rapidly and it is desirable to salvage the calf, especially if valuable blood-

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lines are represented. In some of these instances, surgery should be performed.

Pelvic injuries and multiple pelvic fractures may result in diminished size of birth canal. These injuries may be fresh or healed. At any rate the calf is unable to be delivered in a normal manner. Cesarean section is the procedure of choice.

In cesarean section, as in any surgery, consideration should always be given to the following: Is it necessary? Are there definite advantages or disadvantages? Are there other ways in which the situation could be handled more economically and with a better chance of success? Could the animal be salvaged to good advantage? Is there reasonable chance of success? Does the animal's condition favor recovery? All of these points should be discussed with the owner. Unless they can be answered satisfactorily, surgery should not be encouraged. However, if the owner so desires, even in the presence of unfavorable conditions, the operation should be performed. Calling the unfavorable factors to owner's attention will lend assurance of thoroughness and that utmost care will be taken to guard against mishaps. In the event of poor results, the owner will be less apt to blame the doctor; on the contrary, he will feel that everything possible had been done. Frank and thorough attention to the foregoing points is equally as important as careful surgical technic. As in all public service, it is paramount that one avoid misunderstanding in order to gain public confidence. This is a must in veterinary practice.

Technic

A technic of operation that we prefer varies somewhat from those described in the literature, principally in the operative site. An oblique incision is made on the lateral aspect of the abdominal wall at an angle correlated with a line drawn between the zyphoid cartilage and stifle articulation, dorsal to the mammary vein about two to four inches above and parallel to the flank, and about six inches posterior to the last ribs. The advantage of this site lies principally in shortened time for surgery, provision for drainage, and ease of delivering the fetus. In well over a hundred such operations this past season, we have had little, if any, postoperative complications.

Preparation of the animal is usually preceded by a vaginal examination, determination of position, and palpation through the abdominal wall. At this time, the choice is made between the right and left side, depending on the position of the calf, fullness of the rumen, and other factors. Epidural anesthesia is induced, using from 5 to 15 cc. of 2% procaine hydrochloride solution, depending on the size of the animal. The animal is secured in lateral recumbency and the head tied forward with a halter rope. The hind legs are secured in an extended position with another rope. The front feet may remain free as there is usually little struggling in these animals, or they may be tied in a forward position. The hair is clipped with surgical blade and the area thoroughly scrubbed with surgical soap, followed by a skin antiseptic of choice. A double row of 2% procaine injections are made along each side of the proposed incision. Solution is deposited both subcutaneously and intramuscularly. This type of local anesthetic and restraint has proved quite safe, is free from hazards, and accomplishes complete relief of pain. The animal now is ready to be shrouded and the initial incision made.

The number of instruments needed for this operation consists of two scalpels, a blunt bistoury, two pairs of scissors, vulsellum forceps, four towel clamps, four hemostats, suture needles and holders, and an obstetrical chain or snare. Material that should be on hand includes no. 4 chromic catgut, sterile sodium sulfanilamide, cotton, gauze, synthetic suture material, shrouds, and stimulants. The shroud and extra towels should be clean; these are soaked in a warm noncaustic solution and wrung dry when put to use. The shroud is laid in place and towel clamps applied. An oblique incision, 12 to 20 inches in length, is made through the skin.

A second scalpel is used to incise the muscles and peritoneum. In incising the muscles, quick thrusts are made so that the line of incision will be straight. Because of muscular reflexes, the line of incision will not be straight if the division is made slowly, even though anesthesia is good. In the right flank the omentum is pulled forward to expose the uterus and the intestines packed forward with towels if necessary. This procedure has not been found detrimental. In the left flank the rumen is crowded downward and forward to float the uterus up and over it. The hand and arm of the surgeon is extended into the abdominal cavity and around the uterus. Steady, gentle pressure in an outward motion is applied to the uterus and its contents in an effort to approximate the apex of the horn into the abdominal opening. Enough of the uterus is exposed outside the abdominal cavity to allow fetal fluids to drain to the outside. This procedure is almost impossible to do from any other site of operation. It is of foremost im-

portance in emphysematous and decomposing fetuses. An extension of the abdominal incision is sometimes necessary in these cases. An incision is made into the uterus along the exposed curvature through which the calf had been palpated. The obstetrical chain or snare is applied to the feet, which have been exposed by the surgeon, and a gentle, steady pull applied by his assistant. The surgeon directs traction and facilitates delivery by stabilizing the edges of the uterus as well as guarding against folding of the uterine walls or turning of the head. Either of these may cause tearing or drainage of uterine contents into the abdominal cavity or the incision. When the calf is delivered, it is turned over to the assistant for rubbing and whatever attention it may need if alive. The operator takes further steps to see that fecal fluids do not drain into the abdominal cavity.

In many instances the placenta will be removed with the calf. If not, no special effort need be made to remove the placenta other than clearing the uterine incision for suturing. Most uteri contract rapidly, but when they do not, we administer 5 to 7.5 cc. of pituitary extract. We have yet to see retained placenta following cesarean section. If there has been extensive decomposition of the fetus with varying amount of liquefaction, the uterus is packed with powder, consisting of a mixture of sulfonamides and urea, and a dose of pyrahistine® is given. The uterus is sutured with no. 4 chromic catgut with a Czerny-Lembert suture. The exposed uterus is dusted with sterile sulfathiazole or sulfanilamide and is replaced in the abdominal cavity and returned to its normal position. I think it advisable to try and place the uterus in the pelvic region, as in most cases a large amount of fluid will drain through the vagina and this hastens recovery. All packs and gauze are removed. The peritonium and deep muscles and fascia are picked up and sutured with chromic catgut, using continuous suture. The abdominal wall is also sutured in this manner. The subcutaneous muscles and skin are closed with a continuous suture using a synthetic material, proxplast suture no. 3. Each layer of suture is sprinkled with sterile healing powder. The skin sutures may be covered with flexible collodion to prevent local contamination. At this time or earlier, we administer a therapeutic dose of amfetasul 5%. The shroud is removed and the cow is cleaned, especially the udder and teats in case of a living calf. Ropes are removed and the cow is able to stand with encouragement. Postoperative treatment is as indicated. Neither are necessary if surgery has not been complicated and a living calf is delivered. However, it is advisable to use massive doses of antibiotics. Skin sutures should remain for two or three weeks, or they may be allowed to remain longer.

The above procedure has given satisfactory results. There has been no anesthesia failure. If properly restrained, the animal will not struggle and the operation, as described, can be performed in 20 to 30 minutes.

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Antimicrobial Nitrofurans in Mastitis and Dermatomycoses

(Continued from page 227)

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From a recent audit it was noted that one of every 15 head of slaughter cattle shipped to market was bruised, with a monetary loss of $5.83 per bruised animal. The same check of 500,000 hogs showed an average bruise incidence of 10%, with a monetary loss of $1.83 per hog bruised.—*Livestock Conservation News.*

Canine Histoplasmosis With Reference To Symptoms And Diagnosis*

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ABOUT five years ago, an outbreak of canine histoplasmosis occurred in the vicinity of Nashville, Tenn., and has only begun to subside in the last few months. This outbreak developed primarily in two Boxer kennels and in dogs associated with these kennels. Several females received for breeding purposes contracted the disease and puppies of several others were affected later. Several dogs were infected that were in no way associated with the kennels. While the majority of dogs affected were Boxers, several Cockers, English Bulldogs, and one Boston Terrier contracted the disease.

Upon observing the first five or six patients, there was much doubt as to the true identity of the disease and, naturally, several wrong diagnoses were made. After extended observation of animals that died, specimens of the liver, kidney, lungs, and lymph nodes were sent to laboratories and all reported finding, as well as culturing, the causative organisms of histoplasmosis.

Histoplasmosis is a debilitating disease caused by an intracellular fungus, the yeast *Histoplasma capsulatum*. It is rapidly becoming one of the most important systemic fungus infections of animals as well as of man in several sections, especially the east central part of the United States. This malady was first observed in human patients as early as 1906[1]. The causative organism was not cultured on laboratory media until 1934, at which time it was isolated from a human patient by Doctor DeMonbreum of the Nashville General Hospital; later in 1939, Doctor DeMonbreum cultured the fungus from a dog.

Mesenteric Form

In the animals observed, there was agreement with other veterinarians[2] that it occurred in two forms: the mesenteric and the systemic. In the mesenteric type, the primary symptoms were usually limited to diarrhea, nausea, and abdominal soreness along with gradual emaciation and anemia. Animals usually showed an elevation of temperature ranging from 103 to 105.5 F. and nearly always had some appetite throughout the course of the disease. The most outstanding symptom is persistent diarrhea which may be admixed with blood from time to time, and which is almost impossible to check with usual intestinal astringents. Mesenteric lymph glands reveal varied enlargement from two to 12 times normal size, and are usually rather easily palpated through the abdominal wall. The majority of animals exhibiting these symptoms will live from four to six weeks after first signs of illness are noticed.

Systemic Form

In the systemic form, the usual symptoms are chronic bronchial cough, elevated temperature in early stages, abdominal pain, anemia, paleness of mucous membranes and icterus varying from slight cutaneous sallowness to definite icterus, usually progressing with the disease. Occasionally ulcers of the tongue and submucous hemorrhages resembling Leptospira lesions are found. One symptom, outstanding in practically every case, is what might be described as an extremely strained expression

*Presented at the 35th annual convention of the Southern Veterinary Medical Association, Jackson, Miss., Nov. 17-19, 1952.

and a rather exhausted general appearance. Most of these animals will show loss of appetite in early stages but they are not acutely ill at that time and may partially regain their appetite. Ascites is frequently noticed and occasionally edema in rear legs. Owners have often mentioned that the affected animal will have a very noticeable desire for eating foreign objects such as wood and stones. Most cases of systemic histoplasmosis will exhibit

Fig. 1. Typical clinical picture of histoplasmosis in Boxer female about 14 months of age. Note extreme emaciation and strained facial expression.

symptoms of gradual emaciation and death occurs in from two weeks to several months.

Diagnosis

The primary method of diagnosis was demonstration of the causative organism in bone marrow**. The last rib can be easily perforated with a 14 or 16 gauge needle and a drop or two of marrow aspirated with a syringe. This material can either be cultured or examined microscopically. The fungus can also be cultured from the blood in practically all cases. Upon autopsy, a slide may be pressed against liver tissue, stained, and the organisms thus observed.

The skin test was not satisfactory in diagnosing the disease. Since it is based on the same principle as the intradermal tuberculin test, it is met with varying opinions as to accuracy. The skin test consists of intradermal injection of 0.1 cc. of histoplasmin and examination for swelling and redness 48 hours later[3]. Histoplasmin is a product produced by the growth of the fungus on laboratory media prepared in much the same manner as is tuberculin.

**Practically all of the laboratory examinations were made in the Pathology Department, Vanderbilt University, Nashville, Tenn.

X-rays are frequently a help in making diagnosis, but in most cases lung pathology is quite confused with that of tuberculosis[4]. Palpation of lymph glands in the mesenteric form is added help in making a diagnosis. In general, any dog free of parasites, that exhibits gradual emaciation, suggests histoplasmosis infection. Most dogs observed were from about three to ten months of age; several were from two to six years of age.

One interesting case was a ten-month-old Boxer male puppy, presented to the hospital with a pelvic fracture caused by an automobile accident. The pup seemed to be normal except for the injury, but in approximately two weeks developed typical symptoms of histoplasmosis with death resulting two weeks later. Laboratory examination confirmed the diagnosis. This animal had been the sole survivor of a litter of eight; the other seven had died of the disease before they were six months of age. It seemed apparent that this dog had been harboring the organism and lowered resistance due to the accident allowed the disease to become established.

It is not known how the disease is transmitted from one animal to another, but in one of the kennels where there were about 50 cases, the problem was apparently solved by covering the dirt floors of the runways with brick and concrete, and by eliminating one

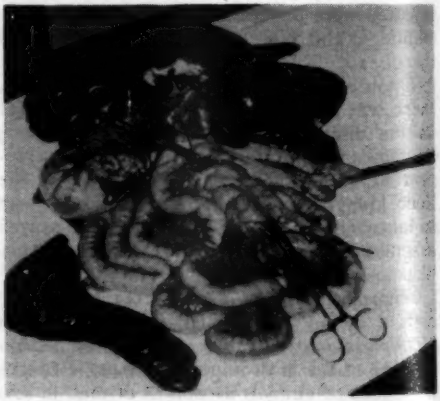

Fig. 2. Viscera of nine-month-old puppy showing typical liver enlargment which is reddish-brown and very friable. The spleen is three times normal size. Note the enlarged mesenteric lymph nodes between hemostats, also enlarged mesenteric vessels.

female which had four litters. Nearly all of the puppies whelped by this bitch died of histoplasmosis before attaining one year of age.

(Continued on page 241)

Diagnostic Radiology*

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IN November 1895, Wilhelm Conrad Roentgen first observed the phenomena of Roentgen rays. Since then, the medical profession has pioneered in development of this valuable diagnostic and therapeutic instrument to a point far beyond the wildest expectation at the time of its discovery.

The *x*-ray machine is one of the most inefficient and dangerous pieces of apparatus employed in medicine today, since approximately 99.8% of the electrons produced are dissipated as heat. Only 0.2% of the electrons actually produce *x*-rays in the tube, and 4 to 5% of these are finally utilized for making radiographs.

There are two methods of using Roentgen rays for veterinary diagnostic work: the fluoroscopic screen, and by recording a permanent radiographic image on film.

Fluoroscopy

Fluoroscopy, as generally employed by veterinary practitioners, is not a safe procedure. Many veterinarians have skin grafts, the result of excessive radiation through careless use of poorly designed fluoroscopic equipment.

It is to be hoped that fluoroscopic equipment will ultimately be developed to be reasonably safe for use with small animals. It is doubtful whether we can achieve any appreciable margin of safety in fluoroscopic examination on large animals. Although it may be possible and practicable on extremities, it does not now appear conceivable that such examinations of thoracic and abdominal cavities may be made with any degree of comparative safety for the veterinary radiologist.

In animal fluoroscopy, the maximum reading that should be used is 7 Ma. and 50-60 Kv.P. The machine must be used only at short intervals of several seconds, and turned off and then on again.

The fluoroscopic table should be lead-lined and the *x*-ray tube should be fitted with a mechanical shutter or diaphragm to control the size of the aperture of the *x*-ray window. This window should keep the field as small as practical.

Film Image

The safe way to record the image produced is on *x*-ray film. Safety is the primary consideration at all times in use of *x*-ray equipment or any radioactive material. Safety to the individuals using the equipment, safety to persons in the immediate area, and safety to the animals being examined are essential. Safety precautions can not be overemphasized. Lead gloves and lead aprons should always be worn in the range of direct and secondary *x*-rays.

X-rays are invisible forms of radiant energy of short wave lengths. They are similar to light in that they travel at the same speed and obey many of the same laws. A distinguishing feature of *x*-rays is their extremely short wave lengths which are only about 1/10,000 that of visible light.

This characteristic is responsible for ability to penetrate materials that would absorb or reflect light rays. The usual range of wave lengths for medical radiography is approximately 0.50 to 0.125 angstroms. The angstrom is a unit of wave length equal to 10^{-7}mm.

X-rays are also refracted, but to such a slight degree that it requires the most refined experiments to detect this phenomena. Hence, the use of any kind of lens is out of the question. Other similarities between *x*-ray and light may be noted but, for the most part, the effects produced are so different that it is preferable to consider the properties of *x*-ray separately from those of other types of radiation.

In discussing the lengths of Roentgen rays, the words "short" and "hard" are used interchangeably. The most desirable rays for radiography are the short or hard Roentgen rays. The longer or soft rays are those that produce skin burns and other difficulties such as back scatter and secondary radiation fog of film. These *x*-ray wave lengths are controlled by the kilovolts, applied to the tube filament. The higher the kilovoltage, the shorter and harder the rays. Most radiographs are made at 50 to 95 kilovolts. The short or hard rays have

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greater ability to penetrate tissue and convert the silver bromide in the film emulsion to silver.

X-Ray Film

Actually, *x*-ray film is basically the same as photographic film. It is composed of an emulsion-gelatin suspension of crystals of silver bromide on both sides of a blue-tinted transparent, cellulose acetate base. Roentgen rays pass readily through film and intensifying screens; these rays expose the emulsion on both sides of the film, producing a greater photographic effect than is possible with a single emulsion.

The crystals of silver bromide in the emulsion require considerable magnification to be visible. When affected by Roentgen rays, a minute part of the crystals separates into the silver and bromide ions. It is these affected crystals which contain the latent image. This image is made visible by development. The affected crystals are changed into black metallic silver.

After processing, the finely dispersed metallic silver appears black, and the different degrees of blackening depend upon the quality and quantity of rays reaching the film. This is controlled by the kilovoltage and milliampere-seconds. The degree of concentrations of silver are known as radiographic densities. The crystals which are not affected by these rays or developer are removed in the fixer solution.

A good radiograph should have the following characteristics: (1) Maximum detail, (2) minimum distortion, (3) sufficient contrast and density to differentiate between normal pathologic tissues so that a diagnosis can be made, and (4) be properly marked, identifying the patient, part, and view.

Detail and Sharpness

In a radiograph film, detail and sharpness are essential; yet there are occasions when detail must be somewhat sacrificed in the interest of speed to reduce motion fog on the film. Best detail is achieved when the anatomical part is thin enough to use a cardboard holder and non-screen or regular film. However, cardboard holders are not too practical in veterinary medicine. The time element is important because of the patients' inability to cooperate.

Movement is a constant problem. Anytime there is movement, there is fogging of the film and lack of sharp distinction. Fogging is seen on animal chest radiographs because, unfortunately, an animal cannot cooperate by holding its breath. The only factor to combat chest motion is speed. By close observation, a chest radiograph of a small animal can be made with a minimum of motion during that brief interval when the chest is completely inspirated.

It is recommended whenever possible that animals be anesthetized for radiography. If anesthesia is not possible, adequate restraint is necessary for best results.

To obtain sharpness and detail, screens are essential. There are three common types of screens: detail, par speed, and high speed. The sizes of the calcium tungstate crystals in screens vary in different speed screens; smaller crystals are used in detail screens, larger crystals in par- and high-speed screens.

We are using Patterson high-speed screens. Some detail is sacrificed in the interest of speed. Again, it must be repeated that best detail on extremities, particularly bony parts, is achieved with cardboard holders.

If several different cassettes are being used, the speed of the screens in each cassette should be checked. Difficulty will be encountered if cassettes contain screens of different speeds. Results will lack uniformity until all cassettes are equipped with identical speed screens.

It is essential that film be uniformly in contact with both screens. This can be determined by use of hardware cloth over a loaded cassette with minimum exposure and standard processing of the film showing the screens that have poor contact.

Dirt or foreign material on the animal, cassette, or screen will result in poor detail.

Another important element in achieving sharpness and detail is positioning. That portion of the animal to be studied should be closest to the cassette. It is necessary that the tube focal spot be in direct alignment with the object and the cassette.

Whenever possible, two radiographs at right angles should be made of a part, a lateral, and an anterior-posterior view. Actually in animals, body-radiograph, anterior-posterior, and posterior-anterior are misnomers; the terms dorsoventral and ventrodorsal are more accurate descriptions.

The size of the focal spot is an important factor in obtaining maximum detail. The fixed anode tube is commonly used by veterinarians. The size of the focal spot is comparatively small—the smaller the focal spot, the better the detail of the radiograph. The cost of rotating anode machines is prohibitive, as a rule, for the average veterinarian. These are economically feasible in a group practice or in institutional work. The most desirable focal

spots would be under 3 mm. in size; that is, have width or diameter of less than 3 mm. With these small focal spots, there is a decided limit to the milliamperage and kilovoltage that can be applied to the tube filament to bombard the anode with electrons for production of photons or Roentgen rays. This is the reason for the rotating anode with the constant changing focal spot, keeping a smaller target which is cooler under high milliampere-seconds and kilovoltage. In therapy, larger focal spots are used because there is no interest in detail; a larger anode is more resistant to heat and dissipates heat more rapidly. This is the reason good radiographs cannot be made with a therapy machine.

Stationary or mobile grids give clearer radiographs of thicker parts. There are two major types of stationary grids cassettes; one type with parallel lead strips, the other with a fixed focus for 30 to 36 inches. Because the lead strips of the fixed focus grids have been angulated for a specified distance, these cassettes are thrown out of alignment more often than parallel grid cassettes.

The Bucky diaphragm, which is actually a moving grid, causes difficulty if object, grid, cassette, and focal spot are not directly aligned.

Distortion

Distortion must be kept at a minimum to produce a good radiograph. To this end, the primary factors are alignment and distance from target to cassette. With longer object-cassette distance and direct alignment, distortion, magnification, and angulation are kept at a minimum. In animals, optimum distance is 30 to 36 inches with machines of 10 to 50 milliamps. Distance should be standardized as much as possible. We are using 30 inches on practically all exposures. While 36 inches are more desirable, additional time is required.

The milliamps-seconds distance relation may be expressed by the following law: The milliamps-seconds required for a given exposure is directly proportional to the square of the focus film distance, when all other factors are constant. The original milliamperage is to the new milliamperage as the square of the original distance is to the square of the new distance, which makes a large increase in milliamps-seconds needed to increase the distance. Resolving this into figures, take the original milliamps as 10, 10 is to X the new milliamps, take the original distance as 30, the new distance as 40, 30^2 is 900, 40^2 is 1600, so the new milliamps is then 18. Doubling the distance 30 is to 60 or 900 to 3600, the new milliamperage reading is 40 milliamps. There are tables where the factors are available for this conversion, up or down. .

Direct alignment is necessary to prevent radiographic distortion. This is readily seen in the use of grid cassettes.

A difficulty is that the animal patient cannot be moved as readily as our equipment. There is the added difficulty of changing of shapes of objects. This change is brought about by the angulation of the tube, improper position of the patient, or rotation of the cassette in relation to the object and the tube.

Contrast

Another feature of a good radiograph is contrast. This is the relation of one density to another. Preferences in regard to contrast and density vary. The measuring stick is that there be sufficient contrast to show tissues and pathology, or to show that there is no pathology.

Contrast is the result of many factors. It is controlled by the kilovoltage and by the milliamp-seconds. Higher kilovoltage produces greater contrast. With low kilovoltage, the rays cannot penetrate the different densities to activate the film emulsion. Moreover, it is well to remember that contrast is also influenced by the processing of the film.

The object of leaded backs on cassettes is to eliminate back scatter and resulting fog. Cones cut down angulated rays and limit radiation to the part with lowering of fog from secondary radiation.

According to some technicians, high speed screens work best at ten to 25 milliamps, par speed screens at 25-100 milliamps, and detail screens at 100 to 500 milliamps. We are using high speed screens up to 50-55 milliamps. We might obtain better results if par speed screens were used but here again, contrast and detail are sacrificed in the interest of speed.

Density

Density of a film equals the amount of light which passes through the image or the translucency of the image. To be diagnostically useful, all densities should transmit some light and, if possible, every portion of the image should contain some silver deposit. Density is also affected by processing and film fog. To secure density and contrast, and good quality radiographs, the following conditions are necessary.

1. The applied kilovoltage should be such that adequate penetration of the given part is obtained and optimum contrast produced.

2. The milliamp-seconds should be adequate to produce necessary radiographic density.

3. Reduction of secondary radiation should be affected in all bony parts by use of cone, grid, and aperture diaphragm.

4. Proper alignment of the tube to the part will assure balanced densities by virtue of correct application of "heel effect."

5. The film must be processed as the manufacturer intended; otherwise, the effort expended on making a satisfactory exposure will be lost.

The Dark Room

An elementary discussion of radiography would not be complete without mentioning the darkroom.

The darkroom should not be a storeroom; it should be used for processing radiographs. The room should be clean, orderly, and with provision made for dry and wet processing on opposite sides of the room. Space should be provided for a film hanger rack where films do not drip on cassettes, stored film, or film in process. It is also essential that chemicals be fresh. Chemicals must be protected from oxidation by using tank covers, and replaced when exhausted. Adhesive tape can be dated and applied to the tank lid when fresh chemicals are mixed. Both developing and fixing tanks should be properly identified to prevent film being put in the fixer before developing. This mistake not only ruins film, but ruins the developer. In most instances, the developer is more efficient when mixed with distilled water.

Optimum time and temperature for processing is five minutes at 68 F. Fairly satisfactory film are obtained at 65 F. to 70 F. The absolute minimum and maximum is 63 F. and 75 F. Processing should be made a constant factor using time and temperature 68 F. for five minutes. Each 14″ x 17″ film removes two ounces of fluid from the developer tank requiring replenishment as needed. A water rinse of 30 seconds between developer and fixer equals better radiographs. Films should be fixed twice as long as developed, and rinsed in running water for 30 minutes after fixing.

Fogged films can occur before exposure. This fog may come from light in the dark room, out-dated film, storage at high temperatures, or improperly closed cassettes. Secondary radiation and back scatter will also fog films. Static electricity fogs films. A grounded wire on the loading table will take static electricity from cassettes.

Half-moon or crescent marks that we so frequently see on radiographs are the result of bending film between fingers. Foreign material on the animal will cast shadows that are not recognizable; adhesive tape is somewhat radiopaque. Barium on the outside of cassettes or on the animals will frequently cause distracting shadows that are difficult to interpret. Orderly routines must be observed in the dark room for consistently good radiographs.

After the film is dried, the corners should be cut to remove the rough holes from the film hanger which mar the surfaces of other films; 14″ x 17″ envelopes are ideal for filing purposes.

Summary

Briefly, the necessary factors for a good radiograph are: (1) A small focal spot; (2) focus-film distance as long as practical; (3) object-film distance kept to the minimum; (4) *x*-ray beam directed perpendicularly to the plane of the film, the central portion of the *x*-ray beam directed to the center of the object; (5) good contact of intensifying screens with the film; (6) patient properly positioned; (7) movement of patient or tube minimized; (8) sufficient kilovoltage to penetrate the object and produce image contrast on the film; (9) milliamp-seconds high enough to produce desired density; (10) use of cones, grids, aperature diaphragm to reduce secondary radiation; and (11) constant, careful attention to all factors including processing in making a radiograph.

Finally, all that is needed is a good view box to study the film. It is suggested that the practitioner sit down and relax while studying a film, for it is amazing how such observation will facilitate accurate reading, highlighting details lost on casual examination.

Good radiographs are part of an animal's case record — as much of a record as case history, symptoms, diagnosis, and treatment. Radiographs serve as a record which can not be refused or denied. Frequently clients insist upon radiographs; the client should pay a fee for the duplication of a film. The time will come when radiography will naturally assume its rightful importance in the veterinary profession.

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Two milligrams per day of arsanilic acid, experimentally added to the ration of individual chickens, has been noted to increase poultry growth rates 10%. In this respect, certain arsonic acids were more effective than antibiotics alone. The method of stimulation is not known.

Recent Information On Hookworms Of The Dog*

DONALD E. COOPERRIDER,** D.V.M., M.Sc., Athens, Georgia

WHEN "recent" information is prepared for discussion, it is necessary to consider much accepted information already at hand. Never is a completed study accomplished in which all information is new. Information is accumulated, bit by bit, with one small part contributed by one worker, another by another worker, and so on. In this paper it will be necessary to include a few items of relatively recent information with earlier knowledge.

The most important hookworm, in incidence and disease-production in the South, is *Ancylostoma caninum*. It is found universally and is a problem. Second in occurrence and infection is *Ancylostoma braziliense*, which has an additional important feature of being the cause of creeping eruption in man. Its occurrence, according to Donaldson, *et al.*,[2] is rather spotty throughout the South and Southeast, concentrated most in areas of moist, sandy soil. The third species, *Uncinaria stenocephala*, has not been found in this area.

In the summer of 1951, a total of 50 dogs were surveyed at autopsy to determine the numbers of gastrointestinal parasites present in the area serviced by the veterinary clinic of the University of Georgia. This work has been reported by the author[1]. Forty-three of the animals (86%) were found to be parasitized by from ten to 4,000 *Ancylostoma caninum* per dog, with an average infection of 141 parasites per animal. In another report[3] from the diagnostic laboratory of the same clinic, covering the period between January 1 and December 31, 1951, feces were examined from 1,037 dogs with 488 (47%) positive for *Ancylostoma caninum*.

Our own estimates of the percentage of infection would place the figure close to 86%, rather than 47%. Infection would probably be much higher in areas further south than the locality studied, and lower in areas to the north. This is demonstrated by comparable reports of Koutz[5] from Ohio, with 17%, and Whitney[6] in Connecticut with 20% infection. Using these figures as a basis, there are more than twice as many animals infected with hookworms in our area than in areas further north.

It is well to consider some of the bionomics of the parasite, especially as they pertain to development of larvae. Infection of the host may be either by skin penetration or by ingestion. The larvae must have certain temperature and moisture requirements in order to reach the stage necessary to accomplish infection. Much work has been reported which indicates that as temperatures of the media decrease from 98 F., the time required for development is extended. At this temperature, less than three days are needed for larvae to reach the infective stage. As the temperature decreases to 40 F., development times are increased until, at that temperature, larvae do not hatch from the egg. Thus, we can more readily understand low infection rate in animals where there is freezing of the soil in winter. Results of our own pilot experiments support these data.

There is much discussion as to the proper drug to use as an anthelmintic in hookworm infections. There are several that have demonstrated anthelmintic action. Among the most popular of these are tetrachlorethylene, methyl benzene, toluene, and n-butyl chloride.

Tetrachlorethylene is the most effective but at the same time the most toxic to the animal and greater care must be exercised in its use. Other drugs can be used more safely under most hospital conditions but are probably not as effective.

There are several technics that can be employed in administration of these drugs. In our own clinic, we prefer treatment with no starvation. An enema of sodium bicarbonate solution is given, followed by oral administration of the drug, with a second enema given two to four hours later. In addition, blood transfusions, vitamins, and iron supplements are sometimes considered advisable. Adequate diets and sanitation are stressed. We find it necessary occasionally to advise retreatment in the near future.

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Lesions of Selected Parasitic Infections*

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Many of the most common and important diseases of animals are the result of invasion of the host's body by microscopic or macroscopic parasites. Lesions of these disease processes are of academic interest in that they are a manifestation of complicated host-parasite relationships involved in the particular disease. This is true of those diseases which are caused by bacteria and viruses, as well as those produced by metazoan parasites with which we are concerned at the moment. These lesions have more than academic importance; they are of practical importance in several ways. The lesion itself may be responsible for some of the symptoms; the parasite may be protected from chemotherapeutic attack while it is within the lesion; and the lesion may be of diagnostic importance, especially if the parasite is small and difficult to demonstrate grossly.

To illustrate and emphasize these points, characteristic lesions of four parasites, each of a different host animal, have been selected: (1) *Spirocerca lupi*, the esophageal worm of dogs; (2) *Trichostrongylus axei*, the small stomach worm of horses and mules; (3) *Ostertagia ostertagi*, the medium stomach worm of cattle; and (4) *Aelurostrongylus abstrusus*, the cat lungworm.

Lesions of Esophageal Worm

The esophageal worm of dogs is rather common in some areas. Over a three-and-one-half-year period we have found approximately 6% of 661 dogs infected. This worm has a complicated life cycle in which developing worms migrate from the stomach to the esophagus by way of the aorta. The worms that reach the esophagus stimulate a host tissue response which results in production of characteristic nodules in the wall of the esophagus. Rarely these nodules will be in the trachea or bronchi. An aneurysm may develop in the wall of the aorta, which may be so weakened there may be spontaneous rupture, with death from hemorrhage.

In this infection the lesion may produce some of the symptoms. Worms within the lesion are protected quite well from anthelmintic treatment, and the lesion may be of diagnostic importance.

Lesions of Small Stomach Worm

The adults of *T. axei* are only about one-fifth of an inch long, and are commonly embedded in the mucosa of the stomach of horses and mules. A high percentage of the animals autopsied are infected, some of them with large numbers of worms. By artificially digesting aliquot samples of stomach mucosa of one animal with an average infection, it was found that there were approximately 10,000 worms in the stomach mucosa.

The mucosa of the affected stomach will be thickened, greatly congested, covered with tenacious mucous exudate which often may exhibit circular or irregular areas of involvement. On routine postmortem examination, worms will probably not be detected unless scrapings of the mucosa are examined microscopically. Thus the lesion is of importance in making a diagnosis, and it is apparent that the parasite is quite well protected against treatment so long as it is within affected tissue.

Lesions of Medium Stomach Worm

The adults of *O. ostertagi* are only a little larger than those of *T. axei*. Within a few days after the calf or cow is infected, immature worms migrate into the glandular crypts or within the mucosa where they stay for approximately three weeks or more. As a result small nodules are produced on the mucosa where each penetration occurs. In some places small vesicles or necrotic foci may be seen.

As was true for Trichostrongylus, the worms within the lesion are protected against treatment, and the lesion is of diagnostic importance. The adult worms on the surface may be overlooked easily if care is not taken in examining the material.

Lesions of Cat Lungworm

The cat lungworm, *A. abstrusus*, appears to be rather uncommon but widely distributed. From the few reported cases, this parasite appears to be more common in the southeastern states, having been reported from Maryland, North Carolina, South Carolina, Georgia, and Tennessee. Snails, or slugs, serve as a required intermediate host, and there may also be transport hosts such as small rodents.

(Continued on page 241)

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Observations And Evaluations Of Certain Fungicides In Canine Dermatomycosis*

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THE multiplicity of drugs available for treatment of mycotic skin conditions is, in itself, good indication that no specific therapy has been demonstrated. Methods of treatment for these common conditions often leave much to be desired; a search for more effective fungicides is constantly being conducted.

In general, the currently accepted forms of therapy fall into two categories: (1) topical applications and (2) physical agents. Topical applications include the fungicides, soothing agents, and keratolytics. An example of a physical agent is the Roentgen ray.

Soothing agents find their greatest value when acute inflammation is present. In these cases, the primary mycotic condition must temporarily assume secondary significance. Keratolytics are useful in peeling off the stratum corneum which contains many fungi. By doing away with extraneous materials they also prepare the way for fungicides to act more effectively.

Treatment Evaluation

Any attempt at evaluation of fungicidal activity must take into consideration *in vitro* ratings, tendency to irritate tissue or other toxic properties, and actual clinical effectiveness. In some instances, laboratory ratings are in direct contrast to clinical observations. For example, sulfur compounds are well known for their clinical advantage as fungicides but show extremely poor results in the laboratory. On the other hand, the well-known fungicides, salicylic acid and benzoic acid, are feebly fungistatic alone but in combination show marked activity which corresponds to clinical observations. Effectiveness of a given drug on certain mycoses and lack of effect on other types, have never been satisfactorily explained. This, of course, further complicates evaluation.

For the past one-and-one-half years, a screening program has been maintained in an effort to select fungicides with superior effectiveness against dermatophytes of animals. In addition to the established fungicides, 17 newly-synthesized compounds thought to have some fungicidal properties have been considered to date. In this program, all drugs presented for evaluation first undergo initial, *in vitro* tests. There are several methods for testing fungicidal activity in the laboratory, but basically all involve subjection of the unknown drug in various concentrations to given quantities of spore suspension. Eight strains of fungi known to be pathogenic for animals have been used. Dilutions of the drug are made in liquid media containing known spore concentration. After a 30-minute contact period at 37.5 C., subcultures are made on nutrient agar slants and observed for five days.

Promising drugs are toxicity tested by oral administration to rats and applied to scarified rabbit skin to determine the degree of tissue irritation. Drugs passing these tests are considered ready for experimental clinical evaluation. Results to date could be considered evidence of failure of this program, but they actually represent a real tribute to the observations of veterinary practitioners. Two outstanding fungicides have been recognized and both were called to our attention by practicing veterinarians.

Experimental Fungicides

Dr. R. J. Cyrog, Skokie, Ill., recommended a drug called cunilate for chronic fungoid (unclassified fungi) dermatoses and supported his observations with case reports on over 100 cases of dry, deep-seated skin conditions previously resistant to medication**. The effective constituent of cunilate is solubilized copper-8-quinolinolate, a superior fungicide developed at the request of the United States Air Force for fabrics preservation.

On the basis of Doctor Cyrog's clinical observations, cunilate was subjected to a screening program and passed on all counts. The primary limitation revealed was its low degree of solubility. Vehicles which dissolve adequate quantities of this agent, alcohol and acetone,

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**Doctor Cyrog's observations will be published in the near future.

are highly irritant. In further clinical observations, Cyrog found that cunilate is of greatest value in dry, scabby, fungoid dermatitis.

The other outstanding fungicide was reported by Dr. T. A. Newlin, Dover, Del. Doctor Newlin supplied excellent case reports on a new compound, dicyclohexylpyroborate. Although this compound showed a slightly lower fungicidal rating than cunilate, it also exhibited excellent germicidal properties. *Staphylococcus aureus* was inhibited in three minutes and completely killed in four minutes. On application of dicyclohexylpyroborate to skin lesions, a powder-like film was observed which in clinical cases proved to be soothing to irritated skin. There were indications of a stinging sensation which was followed by an immediate reduction of scratching. This film also possesses the ability to dehydrate or dry moist, suppurative lesions thus permitting exudate and debris to be removed as dry crusts. This property appears to function only in the presence of excessive moisture, for tissue dehydration beyond the normal state has not been observed and affected areas become soft and pliable. Additional clinical usage has demonstrated the safety and usefulness of dicyclohexylpyroborate on dogs, cats, fox pups, and mink. In addition to clinically diagnosed ringworm, 130 cases of dry, chronic eczema have responded favorably. Results on 40 cases of moist eczema have been most encouraging, especially in and around the ears. Tail biting, apparently a fungus-caused anomaly, has been controlled in over 100 mink. Four hundred, undiagnosed lesions in fox pups have also exhibited marked improvement.

In view of the individual merits established for these two compounds, a combination of the two has been prepared and has been subjected to preliminary tests. Experimental, clinical evaluations are currently being concluded. The search for more effective fungicides continues, but observations on the combination of cunilate and dicyclohexylpyroborate are most encouraging.

Diagnosis

So far, this discussion has dealt entirely with treatment of some skin conditions vaguely described as superficial mycotic infections. Treatment before diagnosis is placing "the cart before the horse" and is an unsound clinical approach. However, this procedure is necessitated by lack of factual information on causative agents involved. In spite of the prevalence of the condition, there is not adequate published information to describe our clinical observations in standard terminology, establish a reliable prognosis, or even recognize drug specificity for a given condition.

The literature describes *Microsporum canis*, an organism identical to *Microsporum felineum* and *Microsporum lanosum*, as the principle cause of canine and feline ringworm, and mentions the sporadic occurrence of favus in dogs and cats. However, experience indicates that the typical lesions attributed to these organisms do not adequately describe a great many cases that respond to mycotic therapy. It has not been established that fungi, normally saprophytic, can penetrate debilitated tissues and become pathogenic. Thus, so-called fungoid conditions are not even recognized. Trichophyton infections in small animals have received little attention but during these studies this organism has been cultured from skin conditions considered to be dry eczema. Obviously, too little is known concerning mycotic conditions, and many questions will remain unanswered until studied further.

The confusing taxonomy of fungi and lack of convenient diagnostic methods have handicapped the clinician in making a specific diagnosis of mycotic infection. In recent years, classification has been simplified and the pathogenic dermatophytes now fall into three genera. They are Trichophyton, Microsporum, and Epidermophyton.

The simplest and yet the most important single means of laboratory diagnosis is direct examination of skin and hair scrapings under the microscope. The method proposed by Connett is simple and requires little equipment. Scrapings are collected between two glass slides which have been previously sterilized and wrapped in paper. Material is placed on one end of a slide in a drop of potassium hydroxide (10 to 40%), a cover glass is applied and the drop is heated gently over a low flame. Mycotic material should reveal branching filaments. Affected hairs show involvement of the hair shaft with spores arranged in chains either internal or external to the shaft.

Recently, a technic has been tried for staining fungi in skin scrapings with basic fuchsin. The ease in locating stained fungi justifies the extra effort required. This technic, developed by Klingman and associates at the University of Pennsylvania, appeared as an abstract by Dr. R. D. Turk[1].

With knowledge that mycotic growth is present, treatment can be initiated, but for specific determination of the causative agent, cultures must be prepared. Culturing is not a difficult procedure and can guide treatment and assist in making accurate prognosis. Material is collected in the same manner as for

microscopic examination; however, scrapings should be maintained between wrapped, sterile slides for five days to allow desiccation of bacteria. Suspect material is then placed on Sabouraud's glucose agar. This particular media is available from Difco Laboratories, Detroit, Mich.

Cultures are held at room temperature and full growth may require two to three weeks. Identification of fungi on the basis of taxonomy is a highly specialized field, but examination of cultures with the use of ultraviolet radiation through a Wood's filter can yield much information to the clinician. The florescent properties of the various species have been found to be their most stable feature on culture media and have been described by Lewis and Hopper[2]. This book will prove practical and useful to the clinician interested in medical mycology.

In addition to differentiating fungi on culture, filtered ultraviolet light has found great value in following the progress of mycotic infections and in determining when cure has actually taken place. A small, compact, inexpensive instrument for this purpose is the mineralite.

For ultraviolet examination of the patient, the light has its greatest value in infections of the hair. Microsporum-infected hairs appear as luminous, short, yellowish-green stubs. *Trichophyton endothrix* is dull and bluish. *Trichophyton ectothrix* does not fluoresce. The causative agent of favus is greenish, but less luminous than infections due to Microsporum.

In human medicine there is a phenomenon recognized as dermatophytid or "id" eruptions. These eruptions are caused by antigenic substances from localized fungus infections disseminated through the body to sensitive skin areas, where they cause eruptions not resembling the original infection. Dermatophytid lesions range from erythematous to vesicular of rather acute nature. Fungi can not be isolated and lesions disappear when the primary fungus infection is curbed. This phenomenon apparently has not been described in veterinary medicine but could well be added to the list of problems that need further investigation.

Until we have increased our knowledge of dermatomycotic infections, we can not hope to improve our clinical management of mycotic skin lesions, regardless of the fungicidal potency of newer preparations.

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Canine Histoplasmosis

(Continued from page 232)

Several drugs and antibiotics have been used in attempted treatment, but to date there is no known successful treatment.

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Parasitic Lesions

(Continued from page 238)

Adult worms, located in lung parenchyma, give off large numbers of eggs which may almost completely fill the alveolar spaces in involved areas. The larvae hatch here and then are passed up the air passages and into the digestive system.

Grossly, the lung will be greyish in color and very firm. Under the visceral pleura may be seen small hemorrhages. Within these are adult worms. These gross lesions are somewhat different from those usually seen in pneumonia.

Since actual incidence of infection is probably much greater than the apparent incidence as based on literature reports, it would be interesting to receive reports from others who have had experience with this parasite.

Conclusion

These examples should serve to emphasize the importance of lesions in many parasitic infections. With better understanding of these manifestations and their development, we will be able to make a more intelligent and effective approach to treatment and control.

Hepatitis X In Dogs*

H. R. SEIBOLD,** V.M.D., Auburn, Alabama

HEPATITIS X is the provisional name of an apparently new type of hepatitis that is being observed among dogs in the southeastern states, and perhaps in other parts of the country. The name hepatitis X has been chosen to differentiate it from other known types of inflammatory disorders of the liver in dogs, particularly infectious canine hepatitis or Rubarth's disease. The name is provisional since the cause is not yet known. When etiology becomes clear, a more suitable name or descriptive title can be chosen.

The disease has been described briefly in an article entitled, An Epizootic of Hepatitis in the Dog (*Jour. Am. Vet. Med Assn.*, 121:201 [Sept.], 1952). The purpose of discussing hepatitis X at this time is threefold: First, to review clinical symptoms and pathological alterations that establish the disease as an entity; second, to bring the profession up to date on information on epizootiology of the disease; and third, to enlist interest and help in solving the problem.

Clinical Observations

Hepatitis X is characterized by anorexia, icteric discoloration of mucous membranes, and a loss of vigor described by different clinicians with such terms as listlessness, dullness, sluggishness, weakness, and prostration. Often there is blood in the feces, and affected dogs appear anemic.

The period of noticeable illness is usually more than a week, although in some cases patients die suddenly without any sign of illness noticed by the owner. In those cases, liver lesions indicate that such animals have been affected for at least several weeks and that clinical symptoms that may have developed were overlooked. A few chronic cases have also been observed having a history of illness lasting one or two months. In chronic cases there was also ascites.

The temperature of affected dogs is usually normal or subnormal. Insofar as various clinical laboratory tests are concerned, there are not enough data to establish averages or characteristic patterns of the disease.

Postmortem Observations

There are three characteristic lesions on postmortem examination. They are icterus, hemorrhage, and liver damage. Invariably the carcass is icteric to some extent. Hemorrhage occurs frequently in subacute cases, less often in chronic ones with ascites. Dogs with hemorrhage show a large amount of free blood in the intestinal lumen. When hookworms are present, the amount of free blood is in excess of what would be expected for the number of parasites. Some patients may show petechial and ecchymotic hemorrhages in the gastrointestinal mucosa, lungs, costal pleura, epicardium, and urinary bladder. Liver damage, which is invariably present, is the most characteristic postmortem alteration. If it were not for the liver damage, it would be impossible to differentiate the disease from leptospirosis in many instances. The liver is either yellow, reddish yellow, orange-yellow, or greenish-yellow. On close inspection, a fine, uniform, reddish mottling can sometimes be seen, approaching the appearance of nutmeg liver.

Histopathological Observations

In the liver of the typical subacute case, three histopathological alterations can be seen. These are degeneration of parenchyma, regeneration of parenchyma, and bile duct proliferation. This combination of changes occurs in a variety of liver diseases, but in hepatitis X it occurs in such a consistent pattern as to justify the conclusion that it is a definite disease entity.

There are interesting changes in the kidneys of some affected animals. There is marked swelling of renal parenchyma, enough to virtually occlude the lumens of the proximal convoluted tubules. This is probably a secondary change: a bile nephrosis or degenerative alteration of kidneys due to presence of bile in the blood stream.

In no instance were intranuclear inclusions found in any of the tissues examined. There is no reason to believe that hepatitis X is in

*Presented at the 35th annual convention of the Southern Veterinary Medical Association, Jackson, Miss., November 17-19, 1952.

**Professor of Pathology, School of Veterinary Medicine, Alabama Polytechnic Institute, Auburn.

any way related to infectious canine hepatitis or Rubarth's disease.

Epizootiological Data

The epizootiological data of the outbreak in the winter and spring of 1951-1952 are given in the aforementioned article. The disease occurred from November 1951 to April 1952, and apparently was present among dogs in Alabama, Florida, South Carolina, Georgia, Tennessee, and Mississippi. Peak incidence was in February 1952. Cases were not submitted to the Small Animal Clinic and the Pathology Department after the end of April 1952 and no cases were diagnosed during the summer. At the end of September specimens were received from Birmingham, Ala. that revealed typical histopathological alterations of hepatitis X. Two typical cases were received from Newton, Miss., on October 15. Two additional cases, representing outbreaks on different premises in Waverly, Ala., were received in October. Thus, a total of five cases of hepatitis X were diagnosed during September and October of 1952.

It is not known how many cases there will be during the coming winter, but studies on epizootiology of the disease should be continued, even during the times of low incidence. Information thus obtained should furnish leads as to possible cause. Veterinary practitioners of the Southeast can help in these studies. Cooperation is needed for reliable determination of epizootiology.

The Pathology Department at Auburn will be glad to receive and examine specimens from dogs believed affected. In return, the histologic diagnosis will be forwarded as promptly as possible. Tissues needed are a slice of liver ¼ in. thick, and a transverse section of a kidney ¼ in. thick. Specimens should be placed in a four-ounce bottle filled with 10% formalin solution (one part of formalin in nine parts of tap water). In order to obtain desired information from the survey, a brief note giving the history, diet, age, sex, and breed of the dog should be forwarded at the time specimens are submitted.

Addendum. Complete data on the incidence during the winter 1952-1953 are as follows: 10 cases were diagnosed at A.P.I. from September 1952, until December 1952. No additional cases have been seen.

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German workers recommend intravenous injection of iodine preparations in addition to local treatment for trichomonads in bulls.

Bovine Leptospiroses

(Continued from page 220)

prophylactic measures are yet available. The pathogenicity of these organisms for man, horses, and swine, in addition to cattle, make this disease a matter of public health and veterinary concern not limited to the cattle population.

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EDITORIAL COMMENTS

Southern Veterinary Medical Association

Jackson, Mississippi, was host to the 35th Annual Meeting of the Southern Veterinary Medical Association. The total registered attendance was 307, including 95 ladies.

Dr. John D. Gadd
President

Dr. Wm. G. Brock
President-elect

Dr. A. A. Husman
Secretary

This city in the deep South was the pleasant locale for discussion of progress made in animal disease control. There was reflected an air of spontaneity and enthusiasm in addresses by prominent speakers, from widely separated parts of the country, concerning advances in veterinary medicine that gave increasing assurance of profitable livestock operations. A large section of the South has enjoyed phenomenal development of diversification in agriculture that includes beef and dairy cattle, sheep, and swine culture. Fields of cotton in this section are being replaced in part by improved pastures for grazing. This is a new industry for the South and is particularly suited to the climate of that region. Lands, given up as useless, have been restored to productivity in which livestock have an increasingly important role. The future promises further expansion, though certain parasitic and disease problems are as yet unanswered. Papers presented at this meeting are featured, in so far as practicable, in this issue of VETERINARY MEDICINE.

Dr. E. H. Durr, Jackson, Miss., was general chairman for this meeting which featured, aside from the literary program, two evenings of entertainment.

Mr. Lee Smith, Jen-Sal representative at Atlanta, Ga., was made an honorary member in recognition of his long service to veterinarians of the South.

Dr. John D. Gadd, Cockeysville, Md., was named president for the ensuing year and Dr. Wm. G. Brock, Dallas, Tex., president-elect. Vice-presidents chosen were Dr. Clyde W. Young, Mocksville, N. Car., and Dean Thomas J. Jones, Athens, Ga. Dr. A. A. Husman, Raleigh, N. Car., was re-elected to the important post of secretary.

The Ladies Auxiliary of the Association held its annual meeting and election of officers. Mrs. S. A. Cox, Jackson, Miss., was selected to serve as president; Mrs. L. A. Mosher, Atlanta, Ga., as president-elect; Mrs. John D. Gadd, Cockeysville, Md., as vice-president; Mrs. J. E. Scatterday, Jacksonville, Fla., as secretary; and Mrs. C. E. Hoffman, Tulsa, Okla., as treasurer.

Atlanta, Ga., was selected for the 1953 meeting. Dates have been set as November 9, 10, and 11; the headquarters hotel is to be designated later. Dr. Clay C. Von Gremp, Decatur, Ga., has been named general chairman for this meeting.

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A.V.M.A. Convention
Toronto, July 20-23

Scrapie Associated with Sarcosporidiosis 40 Years Ago

In his monograph (Investigation into the Disease of Sheep Called "Scrapie"; with Special Reference to its Association with Sarcosporidiosis, Vol. 1, pp. 12-116, Edinburgh, 1914), T. P. M'Gowan describes his investigations of scrapie in sheep in Ecosse County, England. M'Gowan describes the symptoms as persistent pruritus with cutaneous eruptions, gradual emaciation without diarrhea or loss of appetite, and marked uncorrelated locomotion. The disease was described as "always fatal".

At this time it was thought that the disease was a result of infection with sarcosporidia, for these reasons:

1. Sarcosporidia were always present in skeletal muscles of infected sheep. The number of these protozoan parasites was proportionally larger in advanced cases.
2. Pruritus could be produced in rabbits by injection of suspensions of sarcosporidia.
3. Examination revealed that paralysis was due to primary lesions in the muscles.
4. Autopsy findings were negative aside from the sarcosporidiosis.
5. No other hypothesis permitted better explanation.

Investigations in Wyoming by J. W. Scott (*Wyoming Bul.* 262-259), indicated that sarcosporidiosis may be present in 50 to 100% of the sheep in that region. The editors are not aware of subsequent research reports on the inter-relationship of sarcosporidia, be it protozoon or fungus, with scrapie in sheep.

Dangers of Antibiotics in Human Food

The U. S. Food and Drug Administration recently ruled that additions of antibiotics to food for human consumption constitute a public health hazard. Such practices may result in sensitization of large numbers of consumers and the possible emergence of resistant strains of pathogenic organisms.

Dangers inherent in adding antibiotics to food stuffs as preservatives have been pointed out on these pages in previous issues. An example of the practice was the suggested use of subtilin for preserving green beans which could be expected to reduce cooking time, thus making possible a final product having more appealing color.

It can hardly be expected that this ruling will influence the penicillin content of much fluid milk that is already shown to have developed sensitivity to the antibiotic in an increasing percentage of the total population. This is to say nothing in regard to the establishment of resistant strains of disease-producing organisms, interference with a healthy microflora balance in the gastrointestinal tract, or making favorable conditions for development of pathogenic fungi.

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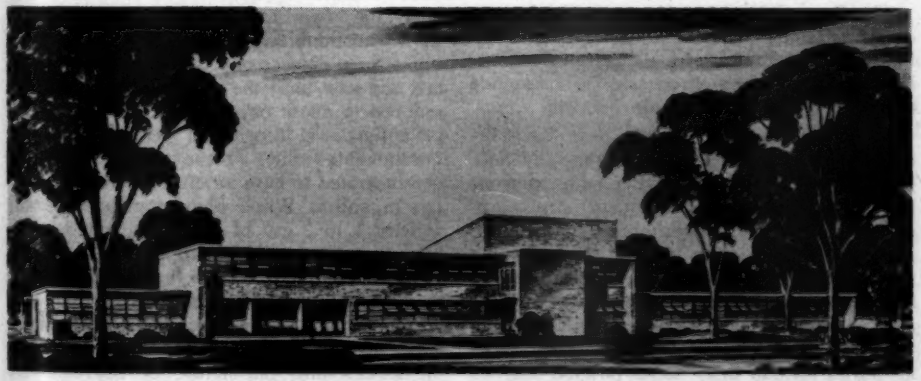
The term atrophic rhinitis may be a misnomer. Some describe the condition as a developmental dystrophy in conjunction with necrosis of affected turbinates. There is also compensatory hypertrophy of unaffected bones.

New Veterinary Hospital and Clinic at Kansas State College



The architect's sketch above illustrates the handsome building on which construction was begun last month on the campus of the Kansas State College. This building of concrete, steel, and native limestone will provide added facilities at the Kansas school for treatment and hospitalization of all classes of animals. Total floor space is approximately 38,000 sq. ft. Present hospital building will be utilized for classrooms and research laboratories.

A.V.M.A.—90th Annual Meeting Toronto, Canada, July 20-23, 1953

The Royal York Hotel will be the meeting place for the thousands of veterinarians who will be in Toronto, Canada, July 20-23, 1953, attending the 90th Annual Meeting of the A.V.M.A.

The meeting will include timely discussion of scientific topics, televised clinical demonstrations, and commercial exhibits.

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Anaplasmosis Conference Report

The Second National Research Conference on Anaplasmosis, met at Stillwater, Okla., on February 18-19, 1953, for the purpose of noting progress in research on anaplasmosis since the last meeting of the group in 1948.

No new arthropod vectors have been incriminated. It was emphasized that any tick, biting fly, or mosquito might readily transmit the disease in nature, provided sufficient numbers are present and opportunities are available for quick transfer from infected to susceptible animals. Some differences in the vector problem were noted. Thus, anaplasmosis transmission in some areas, such as Louisiana and Texas, was thought to be primarily due to large horseflies, while ticks were pointed out as likely chief vectors in California and Oregon. The difficulties of vector control under range conditions were pointed out. The role of mechanical transmission was stressed.

Attempts to immunize cattle against anaplasmosis using various chemically treated tissue extracts have failed, and the question was discussed as to whether immunity can be produced against this disease without actual infection. To date, this has not been demonstrated. The need for additional research into the basic nature of the causative organism was stressed, to serve as a basis for the approach to the problem of immunization.

Some hopeful results on the use of antibiotics, particularly aureomycin and terramycin were reported. When administered early in the disease (after 1-2% of the red cells are carrying marginal bodies) they will stop the course of the infection, however, the usual anemia often develops. Animals treated in this manner are immune as though they had suffered an attack. These antibiotics can not be used as prophylactic agents, because if given before the infection is established, the effect is to prolong the incubation period, but the animal will finally break just as though the antibiotic had not been administered. This poses the important question of proper timing, if these materials are to be used. It is not claimed at present that the drugs are capable of killing *Anaplasma marginale* in the carrier.

The problem of diagnosing carrier animals was discussed, and it was pointed out that the main objective of eliminating the disease from the United States must be kept in mind. Intensified efforts to produce an effective, standardized antigen for the complement fixation test are being made. For the present, the complement fixation test for detection of carriers is still in the experimental stage.

Attempts at chemotherapy of anaplasmosis were summarized and it was concluded that only the two antibiotics mentioned have shown an inhibiting effect upon the causative organism. Since many cases of anaplasmosis are not seen until the red blood cell count is reduced to about one-third of normal, the use of antimalarial drugs and hematinics are of questionable value. None so far have been demonstrated to have an effect upon the causative organism. Whole blood transfusion, using at least 1 to 2 gal. of blood, was cited as the best single supportive treatment.

It was the consensus of those in attendance that the essential problems in anaplasmosis research remain unchanged and that work should continue in each line, with special emphasis on studies into the nature of the causative agent, the diagnosis of carrier animals, methods of biological control, and therapy. — *J. F. Christensen, D.V.M., California, chairman, Advisory Committee.*

Processed Garbage: Key to Control of Vesicular Exanthema

Vesicular exanthema of swine, for 20 years extant only in California, has reached such widespread proportions as a livestock disease that the problem of its control has been discussed by federal as well as state legislators.

Efforts to control this disease in California during the last two decades have failed utterly. These included two attempts at complete eradication by quarantine and slaughter. According to a comprehensive report of the Joint Legislative Committee on Agriculture and Livestock Problems of the California Legislature, a 20-year total of approximately 3,000,000 hogs have been involved in 1,600 outbreaks of vesicular exanthema in that state. Eradication efforts by officials of the USDA and of states where outbreaks have occurred since July 1952 have resulted in the expenditure of millions of dollars and the slaughter of well over a 100,000 hogs — *with the discouraging result that more states were infected in March 1953 than were infected when the national emergency was declared on August 1, 1952.* A press release of the USDA, dated April 17, 1953, states that, as of April 4, 1953, a total of 131,745 swine had been liquidated through the eradication program and 63,928 awaited the same treatment. Direct loss is estimated as exceeding $3,000,000., to which must be added a far greater loss due to factors for which no index exists. These include losses in market values due to quarantine and adverse consumer reaction to publicity, and other inestimable losses. Swine raisers and consumer taxpayers have had to foot these bills.

Experience in California points up two major factors: (1) The character of the swine disease, vesicular exanthema, does not lend itself to practical control by quarantine, slaughter, shipping permits, or other regulatory practices commonly employed, and (2) practically all outbreaks have appeared on garbage-feeding premises.

Hogs are raised on approximately 20,000 premises in California; of this number, 400 feed raw garbage. Over the period 1932 to 1952, on the 400 ranches where raw garbage was fed there were 1,428 outbreaks of vesicular exanthema, while the remaining 19,600 ranches had only 58 outbreaks, nearly all of which were traceable directly to interchange of animals to or from garbage-feeding establishments. Even a cursory analysis of these figures would indicate that feeding raw garbage is the primary obstacle to the control of this disease.

Despite arguments opposed to processing raw garbage, which emphasize cost and equipment needs, legislators are giving considerable attention to evidence supporting passage of bills making compulsory the cooking of all garbage prior to its being fed to hogs and restricting interstate movements of hogs or pork derived from hogs fed raw garbage.

Effective cooperation among interested groups is urged to encourage action that will lead to promulgation of effective control measures and the ultimate eradication of this vesicular disease. In the meantime, growers and veterinarians are cautioned to be on the lookout for further outbreaks.

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A.A.H.A. Minneapolis Meeting

Dr. Louis A. Corwin

The 20th annual meeting of the American Animal Hospital Association held in Minneapolis, Minn., May 6-9, 1953, attracted a large group of guest practitioners interested in small animal medicine.

The excellent program organized to give three- to four-hour sessions to the development of important aspects of each of a group of procedures was a popular feature of this meeting. For example: A half-day was devoted to a symposium on radiology and another to feline practice. Several prominent authorities in each of these fields discussed certain aspects of practical interest. This organization of program material presented in conjunction with closed-circuit telecasting of demonstrations excelled from an educational viewpoint. Dr. George W. Mather, staff

member of the Division of Veterinary Medicine, University of Minnesota, St. Paul, was chairman of the Program Committee. A studio for television demonstrations was set up in the Veterinary Clinic on the University campus.

Dr. Louis A. Corwin, Jamaica, N. Y., was installed as president. Other officers elected were Dr. Charles W. Bower, Topeka, Kan., president-elect, and Dr. William F. Irwin, Tulsa, Okla., vice-president. Dr. Arthur R. Theobald, Cincinnati, Ohio, was re-elected treasurer, and Dr. Wayne H. Riser, Skokie, Ill., was reemployed as executive secretary.

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Mineral Oil May Be Harmful

George L. Becker, M.D., (*Am. Jour. Dig. Dis.* [Nov.], 1952) summarizes effects of mineral oil that are valueless or actually harmful: Mineral oil and its emulsions alter normal gastrointestinal physiology and result in faulty bowel movements; it acts to increase anorectal infection by compression into anal crypts; it retards healing of postoperative rectal wounds; it is absorbed into the body in quantities up to 60%; it interferes with utilization and retention of calcium and phosphorus; it interferes with digestion and absorption of other nutrients; it frequently produces serious loss in weight; it prevents the absorption of oil soluble vitamins—A, D, E, and K; it tends to reduce prothrombin levels; it interferes with estrogen therapy; it is an indirect cause of pruritus ani; it may induce mineral-oil poisoning; it may develop a dependent state so that increased doses are necessary; it may aggravate existing local rectal conditions by converting the rectum into an abnormal reservoir; it is esthetically objectionable; it may cause lipid pneumonia; it may posses minute traces of carcinogenic substances; it makes complete evacuation impossible.

Doctor Becker believes that original therapeutic indications for mineral oil were based on a false premise.

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Award to Dr. A. H. Quin

The gold key of Omega Tau Sigma, national veterinary fraternity, has been awarded Dr. A. H. Quin, vice-president of the Jensen-Salsbery Laboratories, Kansas City, Mo., by the Gamma Chapter of Ohio State University. The annual award is given to "a veterinarian who has shown outstanding national leadership in advancement of veterinary medicine."

A Family Affair

Joanne Gross of Russell, Kan., the only girl in the School of Veterinary Medicine at Kansas State College, Manhattan, has three

Miss Joanne Gross

brothers practicing veterinary medicine and another who is a junior in the K-State school.

A senior, Miss Gross plans to work a year or two with two of her brothers, William and Glenn, in Jacksonville, Ill., and then establish her own practice, preferably in California. Another brother, Dean Rollin, is a practicing veterinarian in San Francisco. Her fourth brother, Robert, is a junior in veterinary medicine, so there soon will be five in the family with degrees in veterinary medicine from K-State.

Parents of the five are Mr. and Mrs. Norman J. Gross of Russell, Kan.

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Veterinary College of Hannover is 175 Years of Age

The Veterinary College of Hannover, Federal Republic of Germany (British Zone), this year is celebrating its 175th anniversary.

The College is one of the oldest and largest in Europe. During World War II, Hannover and the College suffered extensive damage. Working routine has been re-established and a jubilee will mark the historic occasion.

The staff of the Hannover school, through Prof. Dr. R. Volker, extends an open invitation to veterinarians of all nations to attend the celebration from July 29-31, 1953. These dates have been arranged so that visitors may attend before proceeding to the XV International Veterinary Congress to be held in Stockholm, Sweden in August.

PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Hyaluronidase Proved Valuable

The name hyaluronidase is more and more frequently met with in current veterinary and medical literature, and to an extent in the lay press, as indicated by an article in one of America's large circulating journals extolling the virtues of hyaluronidase in the handling of kidney calculus. It is an enzyme, sold under a number of trade names, found in semen, snake venom, testicular extract, some hemolytic streptococci, and other sources. Injected into the tissues, it hydrolyzes the hyaluronic acid in interstitial connective tissue spaces so as to hasten the rate of absorption of parenteral fluids with the exception of whole blood which inactivates it. The enzyme in therapeutic doses is nontoxic and nonallergenic. In animals, therefore, it hastens the diffusion of such solutions as glucose, saline, and calcium when these parenterals are injected subcutaneously.

▾ ▾ ▾

Staining Technic for Sperm

Krishna of the Madras Veterinary College describes in the *Indian Veterinary Journal* (May 1952) a method of semen staining by means of mercurochrome that should be of interest to those called upon to examine semen for its potency. He uses a 1% aqueous solution. Smears of semen are made in the usual manner, air fixed, and the mercurochrome applied for from ¼ to ½ minute; then cleared in flowing tap water and dried by means of blotting paper or by air exposure. The result is bright pink staining of the sperm alone against a white background. There was no fading for at least a year.

▾ ▾ ▾

Warfarin Poisoning

Warfarin, the rodenticide, has such a wide range of safety for animals other than rodents that cats and dogs are only rarely harmfully affected by it. However, there are recorded cases of internal hemorrhage in dogs following the repeated ingestion of this powerful anticoagulant. It is reported that, in its earlier stages, the hemorrhage is readily, though slowly, controlled by the use of vitamin K. In more advanced cases, this must be supplemented by whole blood transfusions.

New Remedies for Ketosis

Various sources of information have been extolling the virtues of preparations that are claimed to be of great value in the treatment of ketosis in cattle. We have no personal knowledge of the value of the alleged remedies.

One such remedy is sodium propionate. (It is indicated that it will be sold under a trade name.) It is related that 4 oz. of this chemical given every morning and evening in the feed or as a drench will produce the desired relief of symptoms in ten days. Another preparation is a form of ACTH which is even more highly lauded as it is stated that one injection causes the patient to return to full feed and normal milk production in two or three days. At any rate, practical use in the field is necessary to demonstrate these claims.

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Sealing the Teat Orifice in Dry Cows

If a practitioner makes a custom of sealing the teats of dairy cows with flexible collodion or other suitable material during the period that the animal is not in production in order to prevent the entrance into the udder of mastitis organisms, he should make certain that he is not sealing in organisms which may already be present. If infection is present when the non-production phase starts, the animal should have antibiotic treatment first; then sealing is permissible.

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Hospitalization of Cats

Panleukopenia is one of the highly virulent cat diseases. A practitioner has voiced the reminder that unless preventive measures are employed a cat will almost certainly contract the infection if it enters a hospital where at any time the etiological virus has gained a foothold. This obtains regardless of the reason for hospitalization. In order to protect these animals presented for treatment in a hospital, they may be made passively immune by administering, at the moment of admission, a prophylactic dose of homologous antiserum. There should not be a ward set aside for cats only; it is better to have them in cages in various parts of the hospital to avoid contact with other cats.

VETERINARY PARASITOLOGY

A. O. FOSTER, B.A., M.A., Sc.D.
Beltsville, Maryland

Abelein's Treatment of Bovine Trichomoniasis

Hammond *et al.*[1] described successful results with bovoflavin salve in treatment of nine of ten bulls infected with *Trichomonas foetus*. Six were cured with one treatment, three required a second treatment, and one was not cured with two treatments. Reported trials to date, including those by these authors and by four previous workers to whom their report makes reference, indicate an over-all efficacy of about 92% for the treatment in question, although aggregate efficacy achieved by workers since Abelein is somewhat lower (84%).

Undoubtedly, success achieved by different workers with this treatment and with others, such as the hydrogen peroxide treatment of Hess[2,3] and the iodine treatment of Bartlett,[4] is influenced in considerable degree by proficiency in technic since, in this instance, medication is tantamount to a tedious surgical procedure.

From the standpoint of control, effective treatment of valuable bulls is a central consideration, and there has been notable progress toward this end during the past decade. Moreover, much has already been achieved toward elimination of the infection by careful attention to a systematic hygienic breeding program, by extension of artificial insemination, and by slaughter of infected bulls that are not of special value because of blood lines concentrated in them. These measures, of course, would lack all promise of success except for the accumulation of basic information, including improved diagnostic measures.

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Diethylcarbamazine, an excellent ascaricide for cats and among the reliable specifics for uncomplicated ascariasis of dogs, is apparently of little value for the removal of large roundworms from poultry[5] but has shown considerable promise as an ascaricide for man[6].

[1] *Cornell Vet.*, 43:121, 1953.
[2] *Schweizer Archiv. f. Tierheilkunde*, 91:481, 1949.
[3] *Proc. 53rd An. Mtg., U. S. Livestock San. Assn.*, 1949, pp. 120-127.
[4] *Am. Jour. Vet. Res.*, 7:417, 1946.
[5] Riedel, B., Group Treatment with Caricide for Ascariasis in Poultry. *Jour. Parasitol.*, 37:318, 1951.
[6] Several reports, including Oliver-Gonzalez, *et al.*, (1949), Etteldorf and Crawford (1950), Loughlin, *et al.*, (1951), and Romana, *et al.*, (1951).

Arsenamide in Canine Filariasis

Otto[7] recommends 15 successive daily doses of arsenamide at the rate of 1 mg. per lb. intravenously as the only treatment that regularly kills adult heartworms, *Dirofilaria immitis*. The drug is available in a 1% solution (caparsolate® sodium, Abbott) for use in a daily dose of 1 cc. for each 10 lb. of body weight. In order to kill microfilariae, which are unaffected by arsenamide and may persist for several months after death of the parent worms, Otto suggests a follow-up with four intravenous doses of stibophen (fuadin®, Winthrop-Stearns) after a lapse of three weeks. He notes that diethylcarbamazine (caricide®, Lederle) might prove useful in lieu of stibophen although it lacks adequate experimental trial to establish correct dosage. The potential advantage of this combination was cited heretofore on this page[8]. It has been noted also that stibophen is still regarded by many as the treatment of choice and appears to have been administered successfully by the intraperitoneal route[9]. Finally, there is the possibility that too little attention has been paid to the promise of certain other trivalent antimonials. Several compounds of this nature have been shown[10] to free the blood of microfilariae after six to 11 daily intravenous injections and to have a sterilizing and slowly lethal action on adult worms.

▼ ▼ ▼

A report[11] on four cases of canine filariasis in the British West Indies emphasizes that skin lesions, rather than the textbook picture, were the outstanding symptoms. Diethylcarbamazine, 8 mg. per lb. of body weight, three times daily for 14 days, used in two cases, produced clinical cure, including disappearance of skin lesions, but did not destroy all the microfilariae. Significantly, the account shows that the animals were brought to the veterinarian because of their skin condition.

▼ ▼ ▼

The dog may be an important reservoir of blastomycosis infection in man and animal.

[7] *Auburn Vet.*, 8:69, 1952.
[8] *Vet. Med.*, 44:460, 1949.
[9] *Ibid.*, 45:381, 1950.
[10] *Am. Jour. Trop. Med.*, 25:263, 1945.
[11] Vaughan, A. W., A Report on Canine Filariasis. *Vet. Rec.*, 64:454, 1952.

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
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Goose Septicemia (Fowl Cholera of Geese)

Goose septicemia is the name given by Curtice in 1902 (Rhode Island Agric. Exp. Sta. Bul. 86) to an acute disease which caused severe losses in geese in Rhode Island. The etiological agent was a member of the hemorrhagic septicemia group of bacteria now known as *Pasteurella multocida.* The disease is identical to fowl cholera of chickens and turkeys. It should not be confused with another disease called exudative septicemia in 1904 by Riemer (*Zentralbl. f. Bakt. I. Orig.*, 37:641) and described in detail by Levine (Diseases of Poultry, Biester and Schwarte, vol. 3, p. 422, 1952) under the name of goose influenza. The cause of the latter disease, according to Levine's quoted reference, probably belongs to the Hemophilus genus. As far as is known, goose influenza has not been observed in the United States.

There have been very few reports of outbreaks of goose septicemia described in literature since the one by Curtice. I am sure, however, that most poultry disease diagnostic laboratories have diagnosed the disease. It has been my own experience that geese are most susceptible of all fowl to natural infection with *P. multocida.* The morbidity in an infected flock of geese is usually high and few birds recover.

The disease in geese is, as a rule, so acute that symptoms are seldom seen before death. If apparent, they include increase in temperature to 108.0-110.0 F. (normal is 104.0-105.8 F.), uncertain gait, diarrhea and finally a sitting or lying attitude is assumed with heads twisted under bodies. Curtice says affected birds often burrow their heads in the ground. Thick, tenacious mucus often fills the mouth and nasal cavity. Necropsy findings in practically all cases are text-book-described lesions which are seldom observed in more than a small percentage of other species that die during outbreaks. These include marked epicarditis and pericarditis with membranes studded by petechial hemorrhage. The mucosa of the intestine is usually studded with ecchymosis or larger hemorrhagic areas. Necrotic foci often are observed in the liver. Marked congestion of all tissues characterizes the disease.

In my own limited experience with this disease in geese, rapid onset and acuteness would make any form of treatment appear useless. I know of no reports on use of antibiotics or sulfonamides, but these agents have been used with limited success for outbreaks in other fowl and would therefore be indicated if treatment could be started before the disease had spread throughout the flock. Sulfamerazine in mash at the rate of 0.3 to 0.5% of the total weight or 0.5 gr. per lb. of body weight given orally twice daily has been reported of value for turkeys. Streptomycin administered in doses of 12,500 micrograms per lb. of weight prevented artificially produced fowl cholera of turkeys if given at time of inoculation or within 24 hours thereafter. Penicillin was ineffective for turkeys (McNeil and Hinshaw, *Cornell Vet.*, 38:239, 1948).

Neither sulfamerazine or streptomycin have prevented recurrence of the disease, but may be of value in stopping losses for sufficient length of time to allow for development of birds to marketable age. Usual sanitary precautions and good management are necessary procedures in helping to prevent losses.

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Tongue Deformities

A tongue deformity in turkeys, characterized by permanent curling of the tongue has been described by Sanger *et al.* (*Jour. Am. Vet. Med. Assn.*, 122:207, 1953). It appears to be typical of a similar condition produced artificially in chicks by Grau (*Proc. Soc. Exptl. Biol. and Med.*, 59:177, 1945) by feeding diets deficient in leucine, isoleucine, or phenylalanine. The etiology in turkeys has not been determined. In two flocks of turkeys observed by Sanger *et al.*, 6% of 1,000 birds in one flock and 2.5% of 9,000 birds in another had deformed tongues. Turkeys with this deformity exhibited rough feathering and were underweight. A common observation was feed lodged in the intermandibular space to an extent which interfered with eating. No satisfactory method of control was reported.

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The ten leading states in turkey production in 1951 were California, Minnesota, Virginia, Texas, Iowa, Oregon, Utah, Missouri, Pennsylvania, and Ohio.

Treatment for Blue Comb Disease In Chickens

C. W. CROMLEY, D.V.M., Ashville, Ohio

Blue comb disease has been a problem to the poultry raisers in this territory. Magnesium sulfate and bowel antiseptics have not always accomplished the desired results. During the past season, terracon 25® was successfully used in the drinking water during several outbreaks. This product, manufactured by Chas. Pfizer & Co., contains the equivalent of 25 gm. of terramycin hydrochloride activity per pound of material. Treatment prescribed has been the administration of one ounce of terracon 25 per ten gallons of water for four or five days. The following case reports are cited as typical examples of the use of this agent in the control of blue comb disease in farm flocks.

Case 1. Leghorn pullets (200 in flock). Several birds exhibited darkened combs, diarrhea, weakness, and anorexia. Two had died. Treatment was as follows:

One pound of magnesium sulfate per three gallons of water for five hours, followed by terracon 25 at the rate of 1 oz. per 10 gal. of drinking water. There was little or no improvement at the end of 24 hours. Treatment was continued, and at the end of 48 hours, the chickens were eating better. Two more birds died. The flock continued to improve, and treatment was stopped after the fifth day.

Case 2. White Rocks (300 in flock). Symptoms included darkened heads, diarrhea, weakness, and poor feed consumption. Terracon 25 was administered at the rate of 1 oz. per 10 gal. of water. At the end of 24 hours, no new cases had developed and the birds appeared to be brighter and more alert. After 48 hours, feed consumption was restored and the birds were more active. Only one bird was lost after the onset of treatment. Recovery was rapid since treatment was applied in the early stages.

Case 3. New Hampshire Reds (450 in flock). These birds consisted of two age groups; one of which was in about 30% production, the other only three months of age and nonproductive. These chickens had been sick for four days. Eleven birds died the day before treatment was started. Succeeding losses were as follows:

Day of treatment	21
Day after treatment	10
Second day	6
Third day	0
Fourth day	2
Fifth day	0
Sixth day	1

Many birds too severely affected to either eat or drink were treated individually by hand-dosing with the concentrated solution of the drug. Most of these birds were saved. Several surviving birds were destroyed after two weeks since they had become worthless culls. Without the use of terramycin most of this flock would have been lost as a consequence of the outbreak.

Case 4. New Hampshire Reds (250 in flock). One bird had a darkened comb and diarrhea, but the entire flock was going off feed. Terracon 25 was administered at the rate of 1 oz. per 10 gal. of water, while severely affected birds were hand-treated. Complete recovery followed without mortality or development of culls. The results in this flock illustrate the advantage of early treatment in outbreaks of blue comb disease before birds are badly off feed, and before severe tissue damage and weight losses have occurred.

Summary

These cases are typical examples of the beneficial action of terramycin in the control of blue comb disease. The use of terracon 25 has been successful in the treatment of 54 affected flocks. It has produced quicker and better results than any other treatment used. If applied early and before severe damage has occurred, and while the birds will still drink, recovery is rapid with little or no mortality.

This agent has also been used prophylactically in the control of the disease. Appearing in one group of birds on premises where chickens were housed in separate buildings, the prompt administration of terracon 25 saved the unaffected group from an attack. Blue comb normally tends to spread rapidly from group to group.

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Nine-tenths of wisdom consists of being wise in time.—*Theodore Roosevelt.*

®Chas. Pfizer & Co., Brooklyn, N. Y.

Salt Poisoning in Feeder Cattle

G. M. BLUBAUGH, D.V.M., Mechanicsburg, Indiana, and GEORGE R. BURCH,* D.V.M., New Augusta, Indiana

A carload of Hereford feeder steers, each weighing between 800 and 900 lbs., was shipped by rail from Mexico to Indiana and then trucked to the farm in two trips. A call for veterinary assistance was received 24 hours after the cattle had been placed in the feed lot.

At the farm it was noted that the cattle were in good physical condition, but that a large number exhibited depression, slight nasal discharge, and anorexia. Appetites had been apparently normal on arrival. The highest fever recorded was 104 F. While the clinical picture was not typical of shipping fever, it was decided to treat some of the affected animals with oral sulfonamides. One animal was sick enough that it did not rise when treated. All of the sick steers were placed in a separate pen. The animals had adequate shelter plus an ample supply of good hay and water. A return visit the following morning revealed that five of the animals had died during the night and approximately half of those remaining were either acutely ill or greatly depressed.

Some steers showed marked colicy pains—lying down, getting up, and kicking at their sides. Only slight fever was noted. Autopsy, conducted on one of the animals that died during the night, revealed severe pathology in the entire gastrointestinal tract. Lesions of acute inflammation of the rumen mucosa were severe. There was a great deal of hemorrhage and edema throughout the entire rumen wall. The rumen contained great quantities of water and some ground ear corn. Hemorrhages were found throughout the large and small intestine.

On questioning, the feeder revealed that there was a small amount of ground feed left in the troughs from a previous feeding operation which had terminated several weeks earlier. The feed remaining in corners of the trough was bright and dry. The feeder also reported that great quantities of water were consumed during the first 24 hours after arrival, the cattle completely emptying the water trough. This was considered to be rather unusual, but since many animals received by rail are somewhat dehydrated, not too much thought was given to this matter. There was no evidence of fresh paint or paint buckets around the feed lot.

A tentative diagnosis of heavy metal poisoning was made on the basis of the symptoms and lesions observed. Samples of feed and portions of ingesta were submitted to a toxicological laboratory for chemical examination.† A prompt report from the toxicologist indicated that material tested did not contain arsenic.

A re-examination of the entire case was made pending further toxicological reports. It became clear that, contrary to the first impression gained, the troughs contained large quantities of leftover feed from the previous feeding operation. Thus it appeared possible that the feed contained some substance toxic to newly arrived steers. Realizing that salt is incorporated in the last ration of feeder cattle to encourage water intake, possibility of sodium chloride poisoning was considered. The newly arrived cattle were quite naturally hungry, and the first truck load went promptly to the feed troughs and ate greedily. Ultimately 16 died, the deaths extending from 36 hours to a week after arrival. These animals probably comprised the first entire truckload delivered at the farm.

A later report from the toxicologist revealed that the feed samples submitted contained large amounts of sodium. Sollman[1] states that if salt is given in large amounts and concentrated form, irritation may lead to severe and fatal gastroenteritis. Symptoms of poisoning in man are restlessness, thirst, rapid pulse, coma, fever, frequent micturition, and dyspnea. The poisoning of 3,000 sheep on salt water resulted in deaths of 62 head during a 48-hour period. The symptoms were twitching, muscular spasms, staggering gait, weakness, and diarrhea[2]. The fatal dose of salt for cattle is given as from 3.3 to 6.5 lb.[3]

Sodium chloride can be extremely toxic to ruminant animals even though adequate amounts of water are available. The presumptive diagnosis in this case was salt poisoning. It should also be emphasized that symptoms observed are comparable to those seen in arsenic and lead poisoning, and initially may slightly resemble shipping fever.

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*Research Farm, Pitman-Moore Company.

†Grateful acknowledgement is given to Dr. Robert Forney of the School of Medicine at Indiana University, Indianapolis, Indiana for conducting toxicological studies.

Hormone Therapy for Canine Mammary Carcinoma

T. A. NEWLIN, D.V.M., and H. J. MOSTYN,
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Mammary glands are a common site of carcinoma in the dog. At least 40% of all malignant tumors involve mammary tissue with nearly every variety of histological structure represented in conformance with the complex anatomy of the glands. Thus, schirrous carcinomas, encephaloid or medullary carcinomas, and adenocarcinomas are found. It is important to determine if the process is diffuse or circumscribed. Retraction of the nipple, attachment to skin, general enlargement of the particular mammae may or may not occur. Carcinoma produces metastasis chiefly by lymphatic spread, therefore involvement of the lymph-bearing tissue carries cancer cells in an ever widening circle. Lymphatic circulation rarely allows malignancy to be confined to a single mammae because lymph flows anteriorally from the foremost three glands on either side, toward the axillae, while posterior glands drain through the inguinal canal to the lumbar group. The character of the mammary system is more obvious during lactation when it forms a continuous sheet from the anterior border of the pectoral muscles to the area of the external genitals.

Chronic eczema of the right posterior nipple of a seven-year-old Collie bitch had been under observation for a six-month period. The condition appeared following generalized systemic infection, which included otitis interna, persistent catarrhal discharge from eyes, and cervicitis. Antibiotics were administered in this instance for two months before favorable results accrued. Later, complete retraction of the affected nipple, which had enlarged four times, and hardening of the entire mammary gland, involving an area five millimeters in diameter, indicated surgical removal of the entire gland.

Because spontaneous reversibility of carcinoma has been reported experimentally following the use of various hormones such as estrogens, cortisone, etc., it was decided to administer methyl androstenediol. This agent possesses chemical structure quite similar to that of methyl testosterone, but androgenic action in test animals is much less than that of methyl testosterone. Homburger and associates[1] have reported that this steroid, like testosterone, has produced palliation of breast cancer in man.

On September 13, 25 mg. of stenediol® was administered orally, and the dosage continued daily until December 13. At this time, the cytologic evidence of carcinoma disappeared. The gland regressed to normal and the nipple reduced to the size of the others. Stenediol was continued, 25 mg. every other day, until February 8, 1953. It was thought that this continued reduced dosage might contribute to arresting further development.

Clinical experience with methyl androstenedial leads to the conclusion that this steroid warrants wider investigation. It offers a new approach to the problem of treating carcinomas.

[1]*Jour. Am. Med. Assn.*, 148:1212, 1952.

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Another Use of the Dyson Trachea Tube

SIDNEY R. NUSBAUM, D.V.M.,
Herkimer, New York

Bovine choke is a frequent problem in areas where cattle have access to potatoes, apples, beets, and turnips. Resultant difficulty, when some object lodges in the esophagus, requires rapid, efficient treatment. The most immediate problem is frequently severe bloat, which must be relieved. If treatment has been delayed, prompt relief becomes imperative.

In my practice, where relief of choke appears to be difficult, I resort to the use of a Dyson trachea tube. This is utilized by incising the skin and underlying tissues in the paralumbar fossa and extending the incision through the distended rumen with a quick cut of the scalpel. The edges of the skin are retracted, and the outer portion of the tube inserted through the skin and then the rumenal opening. The tube is locked in position and bloat relief is provided for any length of time.

We usually find that the most difficult of thoracic choke cases are relieved within 24 hours without damaging use of the probang or rumenotomy as usually performed. I have never experienced significant infection upon removal of the tube.

On one occasion the tube was utilized when a pet goat suffered from recurrent bloat. The trachea tube was used as in the bovine and was left *in situ* for three weeks. Upon removal, a permanent fistula had formed. It is possible that this method may be of use to the physiologist who wishes to have ready access to the rumen.

®Organon, Inc., Orange, New Jersey.

ABSTRACTS OF LITERATURE

Trichomonads Related to Atrophic Rhinitis

Switzer, working with swine affected with atrophic rhinitis (*Vet. Med.*, 46:478 [Dec.], 1951), found that 70 out of 87 (80%) Iowa swine affected with atrophic rhinitis harbored trichomonads, whereas only two out of 72 (2.8%) diseased Iowa swine not affected with the disease were positive. Subsequent experimentation by Spindler[10] *et al.* was conducted to determine the role of trichomonads in this disease. Nasal washings from both rhinitic and non-rhinitic pigs were taken under various conditions and instilled in the nostrils of healthy young pigs with the following results:

The turbinates of two pigs receiving intranasal instillation from proven rhinitic swine were atrophic at post mortem. One pig showed massive inoculation of the digestive tract.

Turbinates of a pig washed with trichomonad solution procured from non-symptomatic pigs were also found to be atrophic after instillation. Trichomonads were also found in the digestive tract.

Washings from non-trichomonadal rhinitics produced slight atrophy in the turbinates of pigs, while those instilled with washings from non-rhinitic, non-trichomonadal swine were found normal at post mortem. Control pigs instilled with normal saline were also normal.

Stored trichomonad solutions did not produce the typical symptoms.

Test pigs flushed with alimentary-procured trichomonads from non-rhinitics showed subsequent turbinate atrophy with concurrent alimentary infection.

Both sides of the nasal cavity were infected despite the nostril of inoculation.

Although not designed to preclude the possibility of bacterial or fungal causatives, these experiments are believed to constitute presumptive evidence that trichomonads are etiologically related to atrophic rhinitis.

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[9]Gillespie, James H., Robinson, James I., and Baker, James A., Dual Infection of Dogs with Distemper Virus and Virus of Infectious Canine Hepatitis. *Proc. Soc. Exp. Bio. & Med.*, 81:461 (Nov.), 1952.

[10]Spindler, Lloyd A., Shorb, Doys A., and Hill, C. H., The Role of Trichomonads in Atrophic Rhinitis of Swine. *Am. Vet. Med. Assn.*, 122:151 (Mar.), 1953.

Dual Infection in Dogs

Canine distemper and infectious hepatitis studies[9] indicate that a mixture of the two specific viruses produced a more severe type of illness in dogs than either virus alone. Both viruses were demonstrable in the blood during the acute phase of illness. Inclusion bodies of both viruses were demonstrated, as was natural immunity against both.

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Trichomonads Detectable During Heat Period of Cows

The principal requirement for eradication of trichomoniasis is detection of the centers of infection. Because it is often not possible to examine all bulls, it is advisable to trace infection from the diseased cows to the infected bulls. The veterinarians engaged in artificial insemination are the proper men for this task.

It is easily possible to find living trichomonads in cows during the period of heat[8]. For this purpose an ordinary inseminating tube attached to a small syringe is introduced into the uterus and a sample of secretion collected from the uterus and cervical canal. It is immediately subjected to a microscopic examination. This procedure made diagnosis possible in 31 of 88 suspect cows.

The collection of culture material for transfer to a laboratory is rendered possible by a modification devised by Dr. V. Caspaar of Graz. He injects a small quantity of culture liquid into the uterus through an inseminating tube. He then aspirates the media with the same tube, and stores it in a sterile test tube to await examination.

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There has been much variance in the diagnosis of demodectic mange, ranging from the empirical to the highly complex. Insofar as oily preparation of the scrapings is concerned, glycerine is superior to mineral oil. Polyvinyl alcohol is useful in the preparation of permanent mounts, and is a clearing agent. Potassium hydroxide (10%) retains its high utility as a preferred agent in the diagnosis of demodex.—*F. R. Koutz, D.V.M., Columbus, Ohio.*

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[8]Jahnel, Johann, Nachweis von Trichomonaden während der Brunst. (Detection of Trichomonads During the Heat Period) *Wien. tierärztl. Monatsschr.*, 39:467 (Aug.), 1952.

ITEMS OF VETERINARY INTEREST

Gloves are a must in dealing with dystocia in a sow.—*W. G. Raudabaugh, Piper City, Ill.*

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In man, gangrene necessitating limb amputation has been reported following intra-arterial transfusion.

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Limited clinical experience has indicated the value of repeated progesterone injection in cows classified as habitual aborters.

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Coccidioides immitis in its mycelial phase inoculated into developing hen eggs, has been successfully cultivated.—*Proc. Soc. Exp. Bio. Med.*, 81:91 (Oct.), 1952.

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Bovine tuberculosis, a serious problem for veterinarians in every part of the world, even now affects from 15 to 30% of cattle in many European countries.

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Minute amounts of cobalt in a cow's feed ration will enable the animal to produce its own daily requirements of vitamin B_{12}. These animals gain faster, have better appetite, and utilize feed more efficiently.

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Some experiments indicate that some classes of livestock eat to satisfy calorie requirements. Conceivably, rations may be at such levels (high calorie) that intake of essential elements for growth, gain, or well-being might be curtailed to the critical point.

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Blue tongue, transmitted by both mosquitoes and gnats in South Africa, is presumably spread by gnats of the same genus in California. The disease is endemic in Africa, and ten types of virus are recognized. The California virus has been identified as a mild strain.

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While it is true that "molasses will catch more flies than vinegar", it is also true that a combination of the two ingredients in the old adage is sometimes best in collecting outstanding accounts. Both over- and under-leniency are apt to result in nonpayment. The diplomatically strenuous practitioner receives his just fee and more—because he is paid quicker.

It is estimated that there are three rats for every human being on earth.—*S. N. L.*

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Stilbestrol pellets in the heads of treated birds, if eaten, can cause estrum following hystero-oophorectomy in the bitch.

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Liquid emulsion creme containing 2.5% benzene hexachloride (0.3% gamma BHC) applied by sponge to ears, axillae, and thighs of new-born lambs has been found effective in protecting them against the tick *Ixodes ricinus* for two to three weeks.

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Hookworms in Dogs

(*Continued from page 237*)

For prevention of infections in kennels, maximum sanitation is stressed. Runs should be constructed to facilitate cleaning and placed where they can be reached by sunlight. Sunlight is extremely lethal for young larvae. Feeding should be done in a sanitary manner with separate pans cleaned between feedings.

If the runs are dirt floored, the sodium borate method of larval control can be used readily. This was described by Horlein[4] and is effective on a practical basis.

In addition, pregnant bitches should be placed on clean ground and in some cases kept on raised wire floors until pups are six to eight weeks of age.

Vitamin injections, crude liver injections, and adequate diet are good fortification against the ravages of dog hookworm.

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